SCIENTIFIC AMERICAN

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COMPOUND MILL ENGINE.

We illustrate a very fine sample of a compound engine working the flax and jute mills of Mr. Etrich, at Taxomer, Bohemia. Our engraving is from *Engineering*. The editor states that this engine was designed by Dr. Proell, of Dresden, and is fitted with a new automatic valve gear, which positively controls the action of the double beat valves, and admits of a very extensive range of expansion. The engine was built by Messrs. Marky Bromovsky & Schulz, of Prague, and presents several features of interest.

The Rolling Contact of Bodies.

Professor Hele Shaw lately delivered a lecture at the Royal Institution upon "The Rolling Contact of Bodies." He commenced by putting forward the proposition that when a carriage wheel is rolled along, any particular point upon the tire of the wheel always reaches and leaves the ground in a perpendicular direction. In order to demonstrate this, attention was drawn to the fact that on revolving a wheel from which the tire had been removed, the central point at the extreme end of a spoke always reached the ground and remained there only while the spoke itself was in a perpendicular position. Further, in order to make the truth of this statement more apparent to his audience, the lecturer had recourse to a small solid wheel, to one side of which, near the edge, was attached a small brush, so that as the wheel rolled along a level surface, the brush accurately marked upon a suitably adjusted screen the direction of the course taken by that portion of the wheel upon which it was fixed. The diagram so obtained proved to be a representation of a series of cycloidal curves, the lowest points of which were reached in a perpendicular direction.

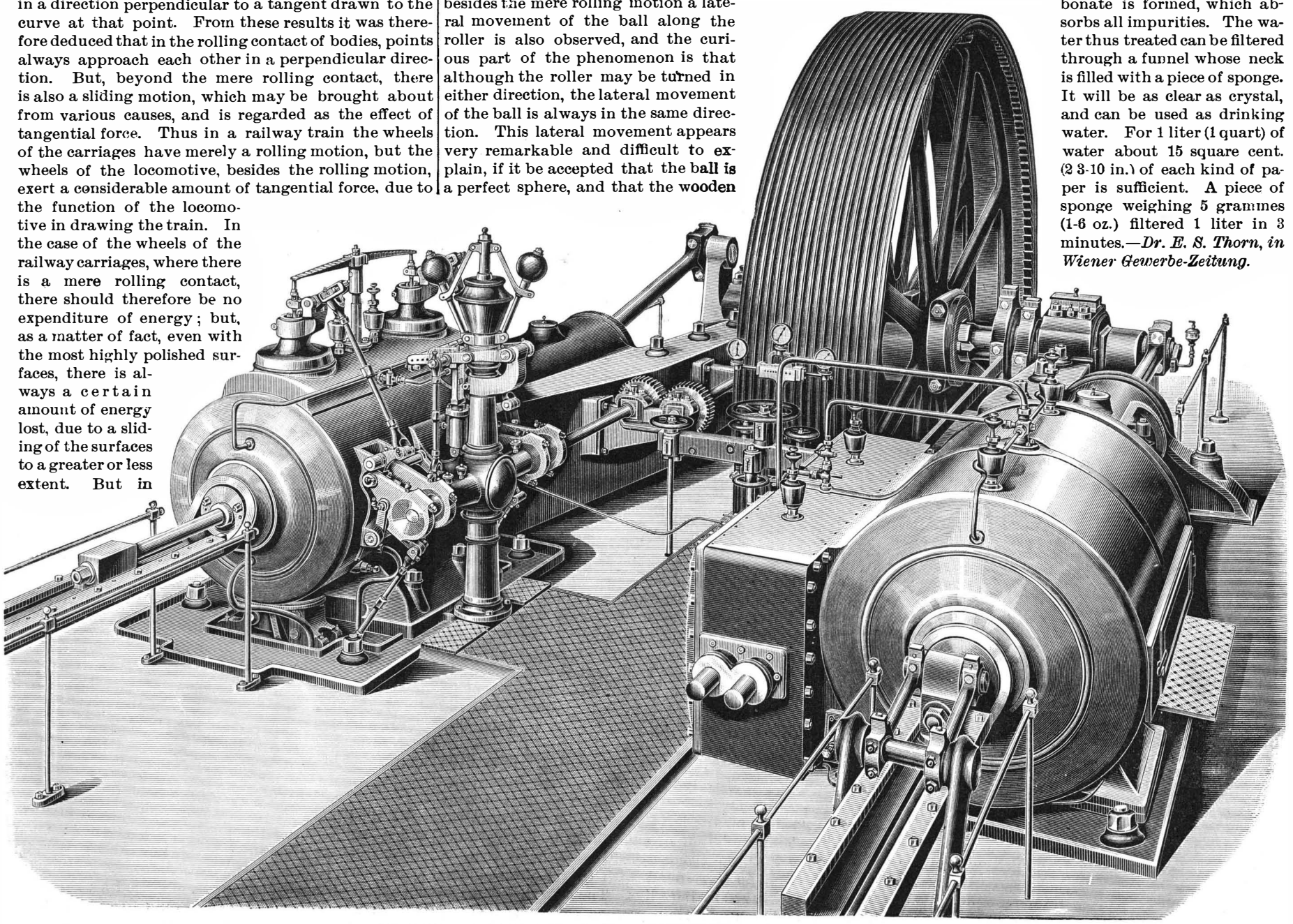
Similarly, by causing the solid wheel to travel in a curved path, any point upon it reached its lowest point in a direction perpendicular to a tangent drawn to the curve at that point. From these results it was therefore deduced that in the rolling contact of bodies, points always approach each other in a perpendicular direction. But, beyond the mere rolling contact, there is also a sliding motion, which may be brought about from various causes, and is regarded as the effect of tangential force. Thus in a railway train the wheels of the carriages have merely a rolling motion, but the wheels of the locomotive, besides the rolling motion, exert a considerable amount of tangential force, due to the function of the locomotive in drawing the train. In the case of the wheels of the railway carriages, where there is a mere rolling contact, there should therefore be no expenditure of energy; but, as a matter of fact, even with the most highly polished surfaces, there is always a certain amount of energy lost, due to a sliding of the surfaces to a greater or less extent. But in such a great measure is this loss of energy overcome, that Professor Shaw quoted a case in which, by means of a system of wheels rolling upon each other, a turntable weighing fourteen tons, when once set in motion, only requires a force of three and a half pounds to keep up its revolutions. The same principle is applied in a number of swing bridges, and in other cases where heavy weights are required to be moved with little power.

The lecturer then went on to explain the application of rolling contact in the employment of machines for measuring distances, and in other instruments, such as Sir W. Thomson's harmonic analyzer for computing the state of the tide at any place for any time. But in all these instruments Professor Shaw pointed out certain corrections had to be made to allow for the tendency of the wheels to slip over each other. In order to illustrate this tendency, the lecturer referred to an experiment in which he had made two wheels revolve round each other ten thousand times, and found then that they had slipped one thirty-second of an inch from their original position, or about one inch in three hundred thousand revolutions. Though this tendency may no doubt be reduced with more perfect instruments, yet to a slight degree it always remains. At the same time Professor Shaw remarked that a minute force exerting itself in a lateral direction would soon have an appreciable effect upon a revolving wheel, although it might be quite imperceptible in its action when the wheel was stationary. This point the lecturer also well illustrated by means of experiment.

He then drew attention to a phenomenon which is observed during the rotation of a ball by means of a revolving cylinder. If a polished wooden ball be placed upon two polished wooden rollers, one of which is kept stationary while the other is made to revolve, a rolling motion is communicated by contact to the ball; but besides the mere rolling motion a lateral movement of the ball along the roller is also observed, and the curious part of the phenomenon is that although the roller may be turned in either direction, the lateral movement of the ball is always in the same direction. This lateral movement appears very remarkable and difficult to explain, if it be accepted that the ball is a perfect sphere, and that the wooden cylinders are mathematically correct and placed in a perfectly horizontal position. If the wooden ball be replaced by one of harder material, or a ball of iron, the lateral motion is perceptibly increased; but the greatest effect is obtained when the wooden rollers are either substituted by rollers of India rubber, or else covered with a sheet of that material. This phenomenon has never been satisfactorily explained, but Professor Shaw now thinks that he has been able to do so, although he only arrived at the solution of the problem which he put forward as recently as the previous afternoon. Of course, when a ball is placed upon a body, its weight causes a certain amount of distortion in the surface of that body, and causes forces to be exerted, acting on the ball from all sides. But when a ball is in motion, the direction of these forces is considerably altered. The direction of the force in the surface of the body in front of the ball during its passage is maintained, and its power is intensified; but the direction of the force in the surface behind the ball is reversed, owing to the release of pressure from the weight of the ball in that spot To these changes in the direction of the forces Professor Shaw ascribes the cause of the phenomenon.

Method of Clarifying Muddy Water.

Filter paper is dipped into a solution of 43 per cent ferric chloride in 57 per cent of water, and after thorough saturation is dried between filter paper. In the same way a second piece of filter paper is treated in a saturated solution of bicarbonate of soda. Now, if a piece of the yellow paper that has been treated with ferric chloride is first placed in muddy turbid water, the fluid is colored yellow by the iron salt. Next, into the same water, a piece of the same size of the bicarbonate of soda paper is dropped, turning the yellow colored water into brown. Thus a ferric carbonate is formed, which absorbs all impurities. The water thus treated can be filtered through a funnel whose neck is filled with a piece of sponge. It will be as clear as crystal, and can be used as drinking water. For 1 liter (1 quart) of water about 15 square cent. (2 3-10 in.) of each kind of paper is sufficient. A piece of sponge weighing 5 grammes (1-6 oz.) filtered 1 liter in 3 minutes.—*Dr. E. S. Thorn, in Wiener Gewerbe-Zeitung.*



COMPOUND MILL ENGINE—DESIGNED BY DR. PROELL.

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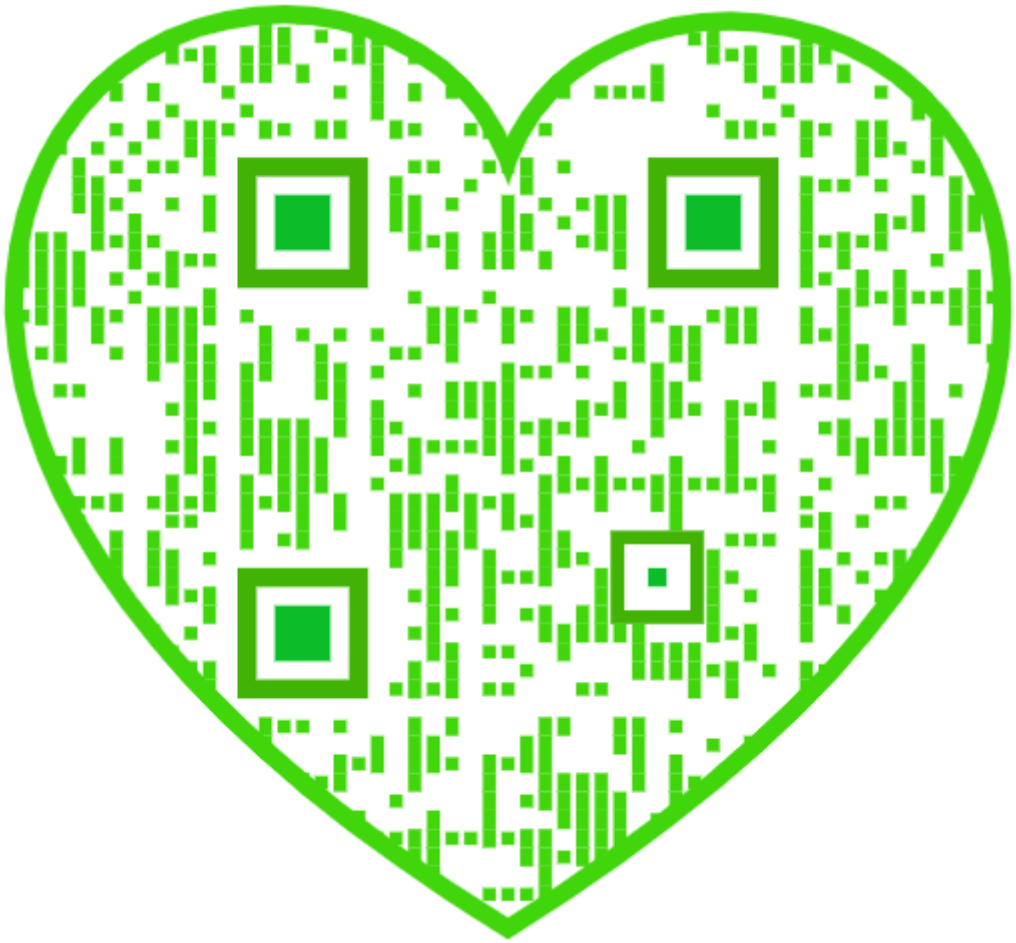

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INVESTIGATING SPIRITUALISM.

After an extended and painstaking investigation, a commission appointed by the University of Pennsylvania, to see what there was in "modern spiritualism," have concluded their labors. They find that it is made up of equal parts of humbug and jugglery, calculated to deceive only the credulous or feeble minded. The appointment of this commission, it will be remembered, is the result of a codicil to the will of the late Henry Seybert, of Philadelphia, whereby the sum of $60,000 was left to found a chair of philosophy in the university, on the condition that it should lend its name to the inquiry. In his later years, Mr. Seybert fell a prey to the wiles of a coterie of slate writers, spirit-form projectors, and banjo players, and he believed that such an investigation would prove spiritualism to belong to the sciences, rather than, as now, to the arts.

The committee appointed by the university was composed as follows: Dr. Joseph Leidy, professor of anatomy and a well known naturalist; George A. Koenig, professor of chemistry; the Rev. George S. Fullerton, professor of moral and intellectual philosophy; Coleman Sellers, civil engineer; Dr. S. Weir Mitchell, the neurologist; Dr. William Pepper, provost of the university; Prof. Robert E. Thompson; Dr. Horace Howard Furness, one of the trustees of the university.

In their summing up they say they did not, in all their investigations, discover a single novel fact, and are "forced to the conclusion that spiritualism, as far, at least, as it has been shown before them, presents the melancholy spectacle of gross fraud, perpetrated upon an uncritical portion of the community."

This is a broad and sweeping statement, and to the minds of many who do not believe in supernatural manifestation, but, nevertheless, have been mystified by certain phenomena, oft recurring, and more or less related to the subject, it is not likely to prove altogether satisfactory. Even if Slade and the other "mediums" examined were unable, as the commission say, to do anything that could not be equally well done by an acknowledged and skillful juggler, like Heller, whom they were so fortunate as to have with them, it remains that there are certain phenomena that, from the time of Emanuel Swedenborg down to the present, have never been satisfactorily explained; and it would seem, since so many have been and are puzzled to account for them, not beneath the dignity of science to separate them from the mass of humbug by which they are surrounded, and enter upon their explanation.

Among these phenomena may be classed "table tipping and walking," the curious and well authenticated "knocking," and, above all, what is known as "clairvoyance." Is the Seybert commission prepared to say that these manifestations are necessarily fraudulent?

If so, they should have their attention called to the findings of an equally reliable commission, formed some years ago, of Heidelberg professors, who, after the same careful investigation, recorded the contrary opinion; one of their number, Herr Heinemann, professor of physics in Heidelberg University, writing an interesting and instructive little treatise on the result of his investigations, where, under the title of "The Fourth Dimension of Space," he attempts to formulate a theory to account for their existence. He does not find in them any supernatural attributes; but, on the contrary, regards them as the expression of a natural force, the characteristics of which he attempts to explain, while admitting ignorance as to its origin.

Wholly outside the circle of professional spiritualists and jugglers, there are those who possess, unconsciously, strange powers. Witnesses testify that tables follow them about a room, and other phenomena, unasked, as they are uncanny, come at unexpected moments. Intelligent and incredulous persons have been astounded by the revelations made them by certain so-called "clairvoyants" as to circumstances and happenings in their earlier lives; things of little consequence, of which even their intimate friends were never apprised, and of which it seems incredible that these "clairvoyants" could have any means of informing themselves in advance.

In his "Transcendental Philosophy," that eminent physicist, Baron Karl von Reichenbach, attempts an explanation of similar phenomena, which he attributes to a force which he calls "odic," or the force of "od." "Od," says an expounder of his theory, "pervades all nature, and is akin to the great physical forces of electricity, magnetism, chemical affinity, heat, light, etc., and always accompanies them, so that wherever they are in action, od is developed, and the strength of its most active development is often in proportion to the energy of their action. As in electricity and magnetism there is a polar dualism, so also there is in od. It has two poles, the positive and negative, which keep company respectively with the electric and magnetic positive and negative poles. The human body is od-positive on the left side and od-negative on the right. This gradation of amorphous bodies from od-negative to od-positive is called the od-chemical order, and is found to correspond with the electro-chemical order established by Berzelius. The odic radiation can be felt and seen by certain persons called 'sensitives,' who have a peculiar nervous susceptibility; while the majority of mankind, called 'non-sensitives,' are entirely insensible to the odic influences and impressions. Odic sensitiveness has many symptoms, among which are liability to somnambulism, capability of being magnetized, inability to sleep on the left side, in the northern hemisphere, dislike of strong yellow colors, fondness for blue as opposed to yellow, dislike of crowds and close rooms and dislike of fatty and fondness for sourish victuals. The causes of many singular phenomena not hitherto understood are explained by the odic theory."

Immanuel Kant, the great metaphysician, recognized the existence of physical manifestations, and so classified them that they might be completely separated from the knowable; and, though he was unwilling to admit the conclusions of Fichte as expressed in the latter's "Revelations," he virtually admitted that he was not altogether prepared to deny the truth of what related to the phenomena. The spirit of the age tends toward investigation. Supposing "spiritualism" is a fraud, as this committee says it is, and innumerable other investigations have shown it to be, may there not be something in the so-called "second sight" and other physical phenomena? May they not be the expression of a natural force, not any more related to the supernatural than are electricity and magnetism?

TO MAKE CHLORIDE OF GOLD.—According to the following, by J. B. Heyl, in the *National Druggist*, this salt can be easily prepared by druggists: "Put a half sovereign or a $2.50 piece in a small evaporating dish, using one, two, or three sizes larger as a water bath, and pour on it ½ a drachm of nitric acid mixed with 2½ drachms of hydrochloric acid and 3 drachms of water; digest at a gentle heat, but do not boil the acid, or much of the chlorine will be driven off in the form of gas. At the expiration of a few hours add fresh nitro-hydrochloric acid in quantity the same as at first, which may be sufficient; if not, repeat the process a third time. Observe that if any silver be present in the gold coin it will produce a flocculent deposit of chloride of silver, thus preventing the solution from being complete. I have found coins with platinum in them, which remains at the bottom, and is easily separated by pouring off the chloride of gold after it is dissolved. Next dilute largely with distilled water, and add a filtered aqueous solution of common sulphate of iron (6 parts to 1 of gold); collect the precipitated gold, which is now free from copper; redissolve in aqua regia as at first, and evaporate to dryness. The weight of a half sovereign is about 61 grains, of which 56 grains are pure gold. This is equivalent to 86 grains of chloride of gold, which will be about the quantity contained in the solution. The most convenient mode of keeping the chloride is in aqueous solution—1 grain to the drachm of water. I have used the above for years."

Impurities of Ice.

Dr. T. Mitchell Prudden, of New York, has been making some important experiments with a view to determining the effect of freezing on bacteria. In the case of the *Bacillus prodigiosus*, there were 6,300 bacteria in a cubic centimeter of water before freezing; after being frozen 4 days, 2,970; after 37 days, 22; and none after 51 days. Of the *Staphylococcus pyogenes aureus*, there were a countless number before freezing; after 18 days of freezing, 224,598; after 54 days, 34,320; and after 66 days, 49,280. Of the typhoid fever bacillus, innumerable before freezing, 1,019,403 after being frozen 11 days; 336,457 after 27 days; 89,796 after 42 days; and 7,348 after 103 days. These facts show that certain bacteria have a remarkable power of resisting the temperature at which ice forms. Dr. Prudden, therefore, recommends that the New York State Board of Health, or other authority, should have power to determine which, if any, of the sources of ice supply are so situated as to imperil the health of consumers of ice.

Liquid Paraffine as a Reagent.

This substance dissolves in all proportions in alcohol and ether, if perfectly anhydrous, forming a clear liquid, which is rendered turbid by the smallest quantity of water or aqueous alcohol. Absolute alcohol takes up only a certain quantity of paraffine oil, and if brought in contact with a larger quantity of paraffine, two clear liquids separate out—pure paraffine oil and a saturated solution of it in the alcohol. If a small quantity of aqueous alcohol is brought in contact with the latter, an immediate turbidity is produced. If 20 c. c. of chloroform or absolute alcohol are mixed with 0·04 c.c. of a 50 per cent alcohol, and a few drops of paraffine oil are added, a distinct turbidity appears. The author finds further that paraffine oil freely dissolves chlorine, iodine, and bromine.—*L. Crismer.*

To Make Paper Adhere to Metals.

M. Eliel gives the following formula for a mixture which can be used for metal, glass, or wood: Gum tragacanth, 30 grammes; acacia gum, 120 grammes; water, 500 c. c. Dissolve, filter, and add 2½ grammes of thymol suspended in 120 c. c. of glycerine; then add enough water to make up the bulk to 1 liter. This bath will keep a long time.—*Revue Photographique.*

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A British Torpedo Fleet.

A flotilla of torpedo boats recently assembled off Portland for full speed trials and general maneuvering at sea. The little squadron consisted of twenty-four of these vessels, of which sixteen were built by Messrs. Thornycroft, four by Messrs. Yarrow, and four by Mr. White. At an early part of the proceedings the fleet became reduced to twenty-two, owing to the Thornycroft boat No. 43 and the Yarrow boat No. 66 coming into collision and having to be withdrawn. The Thornycroft boat was considerably damaged in the bows, but the Yarrow boat would seem to have sustained but little injury, owing doubtless to its greater structural strength. This happened on Monday, May 9, and on the following Thursday the race for speed took place, the course being from Portland round the Ore Stone and back, a run of about ninety miles. The flotilla was formed in six divisions, and soon after the second division had started, the Thornycroft boat No. 27 had to put back with hot bearings. After a while the Thornycroft boats Nos. 41 and 50 were disabled, and drew out of the line. Then occurred the painful catastrophe on board the Thornycroft boat No. 47, which is attributed to the crown of the furnace coming down, owing either to lowness of water in the boiler, or to the circumstance that the crown became uncovered while the boat was rolling, or to want of strength of construction.

A similar accident is reported to have nearly occurred on board the Thornycroft boat No. 57, where the men were hurriedly driven from the stokehold on to the deck by a sudden rush of steam. Three more Thornycroft boats were put out of action, namely, Nos. 42, 45, and 55, the first by reason of defects in her engines, and the second by the loss of a screw blade. We thus have no fewer than seven of one builder's boats disabled out of the twenty-two that started. The race was finished by the remaining boats, the first three coming in in the following order: No. 31, Yarrow; No. 35, White; and No. 46, Thornycroft. The race was thus won by a Yarrow boat, the crew gaining the £15 prize.

The evolutions and the race were carried out under Captain Long, the director of the torpedo school, and who commanded the flotilla. There was some spirited work done both by day and night, which proved the ability of the officers and men to handle their boats. Among other operations, we may mention one which took place at night in order to simulate the attack on a blockading ship at anchor. The Rattlesnake went out after dark, and anchored somewhere between the White Nose and St. Alban's Head. A division of torpedo boats followed at 11:50 P. M. in search of her. The night was dark as pitch, a pelting rain poured down, and it was blowing hard from the W.S.W. As may be imagined, the difficulty of preserving the requisite relative positions of the boats was enormously increased. No light of any description was allowed to be shown, and perfect silence was also maintained. The division went along comfortably for about ten miles at a speed of eight knots, when suddenly No. 44 (Thornycroft) broke down, and although No. 41 went on ahead immediately, she failed to find the rest of the flotilla. The now scattered boats searched about till 1 A. M., when three blue lights burning about two miles ahead revealed the Rattlesnake. The experiment clearly showed how the breaking down of one boat may easily upset a well planned enterprise. No. 44 was third of a string of seven boats, and, breaking down through no fault of her crew, utterly capsized the arrangement. And here we cannot but record the calm heroism of George Platt, one of the victims of the catastrophe on board No. 47. Platt was an engine room artificer, and was in the stokehold at the time of the accident, and made his escape through the water tight door into the engine room, and thence on deck. Almost blinded and frightfully burned and scalded, his first thought was for others. "Turn fire extinguisher cock," he gasped to the deck hands, who were assisting him up the ladder. This cock can be worked from the deck, and his motive was to save the boat. When the surgeon arrived, he first turned his attention to Platt, who nobly asked to be left until his groaning companions were attended to. The maneuvers of the torpedo boats having terminated, they returned to Portsmouth to refit and prepare for the forthcoming review.

The results of the trials cannot be viewed with satisfaction when we see that, during the full speed run, out of the twenty-two boats, the machinery of seven, all Thornycroft's build, broke down. It was not unreasonable to expect that, in experimenting with more or less novel craft, such as these are, some hitches might occur. But such a high percentage of failures could hardly have been anticipated, much less the tragic occurrence which has cost three lives. What remains is the consolation that the officers and men, under the strange and harassing circumstances in which they found themselves suddenly placed, did their duty nobly and manfully, and with an alacrity that indicated the possession of a goodly heritage from their ancestors in the shape of British pluck. The failures must awaken some anxiety when it is remembered that they are confined to the boats of one builder, who has constructed the greater proportion of the torpedo boats in the Royal Navy. Not only does the question affect the country from a financial point of view, and as regards the desire to possess efficient torpedo boats, but with respect to the safety of those who are appointed to navigate them. The outside risks of torpedo work are in themselves considerable, and those who expose their lives to dangers from without should certainly be protected from dangers within by all the means that science has placed at our disposal. It is, so far, fortunate that the failure of these boats, particularly that of No. 47, whatever the cause, should have taken place now, when there is time and opportunity to investigate the matter fully, and to put right what may be found to be wrong. Had the disasters occurred for the first time during an engagement, and had our men found an enemy within as well as without the boats, it might have resulted in national disgrace. We may observe that the boats constituting this torpedo flotilla were ordered by the late administration at Whitehall, and, therefore, if there be any blame, it is not participated in by the present authorities. All the boats which have been contracted for of late are being built by Yarrow, the wisdom of which course these trials clearly demonstrate. It is, however, to be hoped that the Admiralty will direct a complete investigation into the causes of the recent failures, and we trust it will then be found that matters are not quite so serious as at first sight appears, but that small alterations will suffice to render our torpedo fleet efficient.—*Iron.*

The Conservation of Energy.

At a recent meeting of the Manchester Association of Engineers, a paper with the above title was read by Mr. S. Dixon, of Manchester. After referring to a previous paper on the same subject which he had contributed to the Association's proceedings, and briefly stating the principle of the conservation of energy, he went on to trace the amount of power available from the combustion of coal under given conditions. Beginning with boiler making, he said that an exhaustive series of experiments made by Mr. Michael Longridge in 1884 demonstrated that the average efficiency of ordinary Lancashire boilers amounted to about 54 per cent. Comparing this with the effect obtained from the marine boiler, as shown by the paper recently communicated to the Institution of Mechanical Engineers, it was found to be a very inferior result, the efficiency of marine boilers having been there shown to be 80 per cent, the consumption of coal per horse power per hour being 1⅛ lb.

The difficulty of ascertaining accurately what the engine was doing was one which pressed hardly upon any one investigating the subject, as the data commonly related to the engine and boilers combined. In the report of Mr. Longridge just referred to, however, an experiment made on a pair of compound engines indicating 900 h.p. showed that out of the total heat there was utilized about 12 per cent. The author then referred to the law of Carnot, and said that denoting the absolute temperature of the source of heat by T, and the absolute temperature of the condenser by t, the absolute efficiency is given by the well known formula $\frac{T-t}{T}$. Taking the case of the Corliss engines above referred to, the temperature of the steam entering was 309° F., and that of the ejection water 106° F., from which, by applying the above formula, it is deduced that the efficiency of the engines is 26 per cent. The conversion of the whole of the heat into mechanical energy is only possible with a perfect engine, where the temperature of the condenser is absolute zero; but as this is impracticable, all that can be done is to approach this point. Recurring to the case of the Corliss engines named, and comparing their efficiency with that of a perfect engine working between the same temperatures, the result is an efficiency of 41 per cent.

These engines were using 2 lb. of coal per h.p. per hour, but the averages over a number of engines, as given by one of the boiler associations, are as follows:

Compound engines, condensing, 3·66 lb.; single cylinder, condensing, 5·88 lb.; single cylinder, non-condensing, 7·95 lb. Now, comparing these results with those of triple expansion marine engines, as recorded in the paper spoken of, they will be found to be very inferior. The author next referred to gas engines, and took the Otto as an example, observing that, up to the present, the economical results of this engine had not been surpassed. Taking an average of 20 cub. ft. of ordinary gas per hour as used by this engine, and calculating that each foot produces 620 units of heat, the total heat supplied to the engine would be 12,400, and as the units theoretically required for 1 h.p. are 2,564, it shows an efficiency of 20·6 per cent. Applying Carnot's principle, and calculating the efficiency of this engine as compared with a perfect engine working between the temperatures of combustion in the cylinder, viz., 3,000° F. and 1,250° F.—the assumed temperature of the discharged gases—the maximum efficiency would be 58 per cent, and it will be seen that an Otto works with an efficiency of 38 per cent of that of the perfect engine.

An actual experiment established that 29 per cent of the total heat was effective, the remaining portion being represented by 69 per cent absorbed by the water jacket, and 2 per cent from direct radiation. The amount of coal used per h.p. per hour by the Otto when Dowson gas is used is 1·3 lb.; but it has been found that when the Dowson gas is produced from coke, 1·4 lb. are needed per h.p. Turning now to the useful energy finally left after distribution, Mr. Dixon commented on the paucity of information at the command of investigators, saying that in the records of the insurance companies there must be a mass of information of a valuable kind as to the relative efficiency of various modes of communicating power. A gentleman of considerable experience, to whom the author had appealed, had, however, given him some details, which showed that in mills using 800 to 1,000 h.p., it is found that the total energy absorbed by the friction of engines, shafting, etc., was from 20 to 30 per cent of the whole power, sometimes reaching 35 per cent. Of the three main plans for driving, strap driving absorbs 5 per cent, and rope driving 10 per cent, more energy than spur gearing. Referring now to electricity, Mr. Dixon said that Sir William Thomson had asserted that power could be transmitted three hundred miles with a loss of but 20 per cent.

An actual experiment made in Paris during last year established the fact that in transmitting 200 h.p. thirty-five miles, 50 per cent was found to be lost. Even when we thus got the power into the factory or workshop, it would be found that an enormous waste of power was taking place in the operations of all machines, and that this required constant attention. The time lost in the use of machine tools was chiefly that required for setting, which was more than that occupied in cutting. The use of long chimneys was then referred to as a clumsy means of obtaining draught, and forced hot blast was advocated. Mr. Dixon then referred to some diagrams, stating graphically the results obtainable in a perfect engine, and those actually obtained, and showed that with an engine working with steam at a pressure of 200 lb., and the heat in it finally reduced to a temperature of, say, 50° F., the realizable efficiency is only 40 per cent. Against this, Corliss engines are utilizing 14 per cent, and triple expansion engines 15·9 per cent. The diagrams, which were constructed to scale, starting at absolute zero of temperature, showed that the possible efficiency of gas engines was about 83 per cent. The use of a dynamometer in a convenient form was then recommended, in order to test the amount of power actually transmitted through a shaft or machine. The failure of the coal supplies of the country was then referred to, and it was pointed out that a great responsibility rested upon engineers to see that no power was wasted.

The Wonderful Delicacy of the Sense of Smell.

A curious series of experiments has just been completed by Drs. Emil Fischer and Penzoldt (*Liebig's Annalen*, B. 239, i., 131) upon the sensitiveness of the sense of smell. These chemists used mercaptan and chlorphenol as their odoriferous substances, and experimented in a room of 230 cubic meters capacity. A gramme of the substance was dissolved in a liter of alcohol; 5 c. c. of the solution were again diluted to a known volume, and 1-3 c. c. of the latter solution measured out into a flask from which a fine jet could be directed by the experimenter to all parts of the room, the air of which was subsequently agitated by the waving of a flag. At a given signal a second experimenter stepped into the room, and took his olfactory observation, which was checked by the independent observation of a third person. The astonishing result was arrived at that our olfactory nerves are capable of detecting the 1-4,600,000 part of a milligramme of chlorphenol and the 1-460,000,000 part of a milligramme of mercaptan. The quantity of mercaptan present in the air of the room was 250 times less than the amount of sodium present in the air of the room in which Bunsen and Kirchoff made their experiments upon the sensitiveness of the spectroscope, when the sodium lines were just perceptible.

Monument to Galileo.

On the 21st of April, on the occasion of the anniversary of the founding of Rome, the municipality of the Eternal City inaugurated a monument in honor of Galileo, consisting of a column erected opposite the palace of the French embassy, wherein the illustrious astronomer was imprisoned in 1632.

The column bears the following inscription in Italian: "In the neighboring palace, belonging at the time to the Medicis, was imprisoned Galileo, who was guilty of having seen the earth revolve around the sun. S. P. Q. R., MDCCCLXXXVII."

The Syndic of Rome was represented by Assessor Tommassini, who delivered an oration. The University of Rome was represented by Professor Ferri, and the Academy of the Lycei by Mr. Valentine Cerruti.—*La Nature.*

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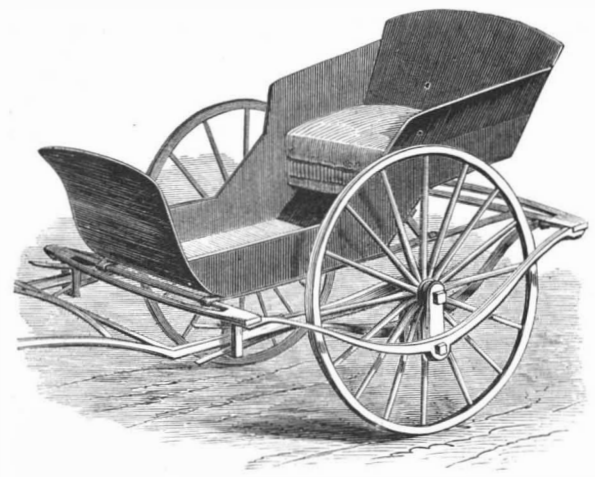
A NEW WAY TO HANG VEHICLES.

The manner of suspending vehicles illustrated herewith forms the subject of a patent recently issued to Mr. Henry J. Diggles, of Fort Jones, Cal. The main frame consists of downwardly curved side strips on either side of each wheel, secured to double forward and rear cross bars, and in connection with the hubs of each wheel there is a short shaft passing through eyes in the rear ends of the thills, there also being links thereon, to the lower ends of which the side bars are connected. Springs are connected above and below to the rear portion of the thills, and extend through loops projecting downward from the under side of the forward cross bar, the springs being intended to hold the thills in about the position shown in the illustration. The vehicle body is mounted upon longitudinal

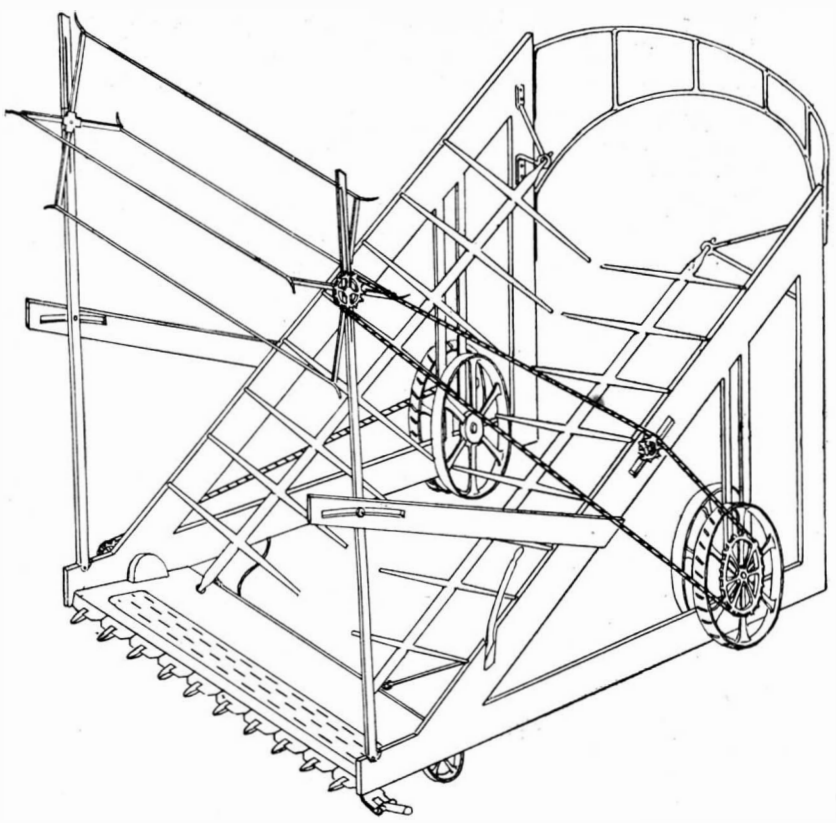


DIGGLES' NOVEL VEHICLE.

springs, the ends of which are hooked, and engage the inner lengths of the double cross bars. With this construction the vehicle body will tend to adjust itself in about a horizontal plane in going up or down hill, and severe jolting and jarring of the occupant are avoided, while the weight of the body, being suspended from, instead of being arranged above, the hubs of the wheels, it will be difficult to overturn such a vehicle.

CORN AND SUGAR CANE CUTTER.

The apparatus illustrated in the cut is for use in connection with an ordinary mowing machine. When attached to and working in combination with one of



THOMPSON'S CORN AND SUGAR CANE CUTTER.

these machines, it converts it into a corn and sugar cane reaping machine, that cuts the stalks, gathers them into bunches, and deposits the bunch as soon as it has attained a proper size upon the ground between the rows and under the apparatus. A framework is attached above and back of the finger or knife bar of a mowing machine. The open center of this frame is filled by two inclined bars arranged to rotate when desired, bearing long teeth arranged at right angles to their axes. Immediately back of the finger bar is a corrugated roller or apron, whose surface is even with the knives, and which continually rotates. As the machine is moved along, the reciprocating cutters cut off the stalks. These fall back on the teeth of the two inclined bars. A horizontal rotating reel or vane assists them in falling backward, while the corrugated roller or apron feeds the lower ends continually backward. The machine cuts two or more rows at once. In a short time enough of the stalks will have accumulated upon the teeth of the inclined bars to form the requisite quantity for a bundle. The operator then pulls the handle seen at the left side, and the rotating bars are both turned inward by connecting rods. The fingers are thrown into vertical planes, and, rotating thus, gather the material together and drop it in the center at such point as the operator may desire. Among the advantages of the machine are the following: It can be attached to any mowing machine; it enables the operator to drop the stalks whenever he desires, in bundles of any desired size; in dropping the stalks, it gathers them into a compact bundle ready for tying or loading; the reel or vane can be adjusted to any height of corn, and makes it possible to cut leaning or standing corn with equal facility.

This apparatus has been patented by A. W. Thompson, of Burlington, Iowa.

A DEVICE TO FACILITATE THE HEATING OF SAD IRONS.

A simple means of bringing the irons to be heated closer to the fire of an ordinary stove or range, so that they will be more quickly heated, without contact with soot, smoke, or gases, and without disturbing the fire, has been patented by Mr. Joseph H. Watson, No. 9 West Broad St., Savannah, Ga. As will be seen by the illustration, the heater consists of a box adapted to receive the iron, with its top shaped to fit a stove top hole in the same way as an ordinary cover. The shape of this box is generally that of the bottom of the iron, but it has a depression forward, giving room for the iron to be easily placed therein, its bottom mainly resting on the bottom of the heater and slightly inclining from rear to front. The top of the box or heater has rabbeted or undercut lips or studs to receive a slotted cover plate, which fits around the handle part of the sad iron, and by the cover handle the heater may be lifted from the fire whether the iron be in it or not.

A Simple Cure for Rheumatism.

A correspondent of the *English Mechanic* says: Let all of "ours" know the following. My wife has suffered occasionally with acute rheumatism in her feet, with painful swelling, completely taking her off her feet for many days at a time.

The following remedy was recommended recently and tried, and took away the agonizing pain in less than fifteen minutes, and she can now walk very fairly, and in a couple of days she will be able to button her boots, and walk without a stick or crutch.

One quart of milk, quite hot, into which stir 1 ounce of alum; this makes curds and whey. Bathe the part affected with the whey until too cold. In the mean time keep the curds hot, and after bathing, put them on as a poultice, wrap in flannel, and—go to sleep (you can). Three applications should be a perfect cure, even in aggravated cases.

The Eskimos.

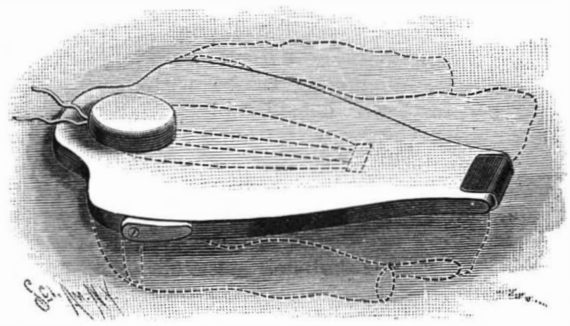
In the *American Naturalist* there is an article by Mr. John Murdoch on what he calls "some popular errors in regard to the Eskimos." One of these "popular errors" is the notion that the Eskimos pass the winter "in a sort of hibernation, in underground dens, living in enforced idleness, and supporting life by stores of meat laid up in less inclement seasons." Mr. Murdoch, who spent two winters at Point Barrow, says this is a wholly mistaken impression. In spite of the extreme inclemency of the climate, the winter, he asserts, is passed by the Eskimos "in one continued round of activity," and he gives a very interesting description of the manner in which they occupy themselves. Another "popular error" on this subject is the idea that the Eskimos always eat their food raw, and devour enormous quantities of blubber.

At Point Barrow, Mr. Murdoch found that food was habitually cooked, although certain articles, like the "black skin" of the whale, were usually eaten raw. Taking into account the fact that the Eskimos have no butter, cream, fat, bacon, olive oil, or lard, he doubts whether much more fat is consumed by them than by civilized peoples.

At Point Barrow the fat of birds and the reindeer was freely partaken of, but comparatively little actual blubber either of the seal or whale was eaten. "Seal or whale blubber was too valuable, for burning in the lamps, oiling leather, and many other purposes, especially for trade."

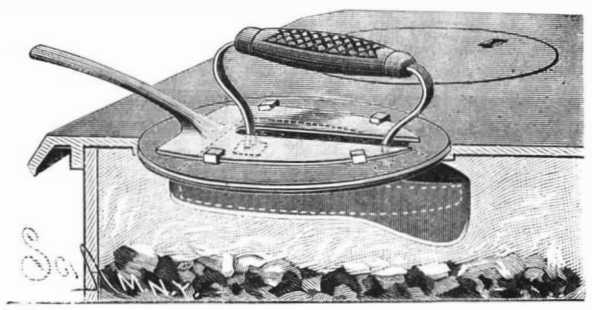
AN IMPROVED IRONING BOARD.

A board designed to hold a shirt while its front and back are being ironed has been recently patented by Mrs. Harriet B. Mavis, of Burlingame, Kansas, and is shown in the accompanying illustration. Its general form is such as to adapt it to be readily placed inside



MAVIS' IRONING BOARD.

the garment, spreading the latter out pretty well toward the shoulders, and on its face is a circular boss, in position to receive the neck band. To the back of the boss, secured by a staple, is attached a cord designed for insertion in the rear button holes of the neck band, thus holding the garment in place. For this purpose, also, a clamp is made to fit on the narrower end of the board, but with sufficient space between its arms to receive and hold to the board the portion of the garment below the bosom. To opposite portions of the board, near the shoulder, are pivoted legs, which lie parallel with the edges of the board

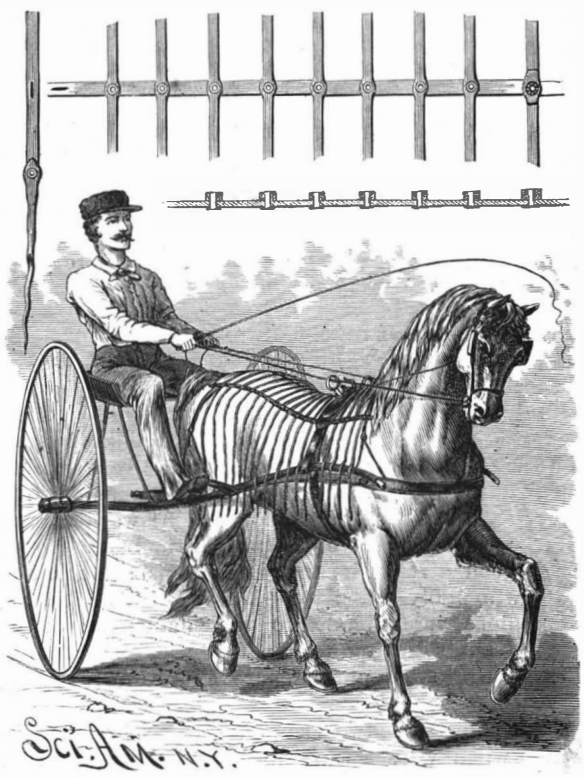


WATSON'S SAD IRON HEATER.

when the front is being ironed, but are pivoted to support it when it is reversed for ironing the back.

IMPROVED FLY NET FOR HORSES.

The invention herewith illustrated is intended to facilitate the production of inexpensive and durable fly nets, and has been patented by Mr. Frank S. Weaver, of E. Weaver's Sons, Moundsville, West Va. The net is made by slitting the lashes and the ribs or bars, respectively, where they intersect, then laying the lashes on top of the ribs and inserting an eyelet through the slits, clinching it at the back or under side



WEAVER'S FLY NET FOR HORSES.

of the ribs. The detail sketch at the top of the picture shows the way in which it is done, one figure showing a longitudinal section. When a lash is to be joined or spliced, the slit ends of its two parts are to be lapped on each other over the slit of the rib or bar, and the eyelet will then pass through three thicknesses of material. In this way of making nets, nearly the full strength of the material is retained, which is not the case when holes are punched in the lash or rib, and by this method of splicing the lashes short strips can be used up, when desired, to utilize material that would otherwise be of no value.

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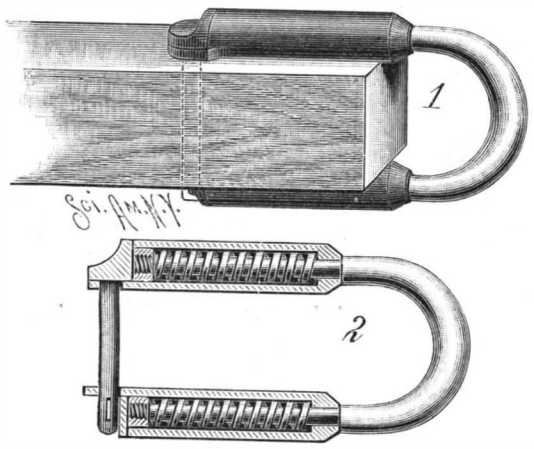
A CLEVIS TO RELIEVE HORSES FROM STRAIN.

The invention herewith illustrated provides a style of clevis designed to relieve horses and harness from strain or injury in starting, being adapted for attachment to plow beams, single trees, etc. It has been patented by Mr. Edward I. Morey, of Whitewater, Wis., and consists in forming the inner ends of a U-shaped



MOREY'S CLEVIS.

rod of diminished size to insert in spring barrels, its extremities being provided with nuts to press the inner ends of the springs and bring the shoulders of the rod against the ends of the barrels, the sides of the barrels being prolonged and having apertures for receiving a bolt. One end of this bolt has a semicircular face adapted to close the end of one of the barrels, and in the opposite end is a transverse hole for a key with head shaped to close the end of the other barrel. A flat section of the rear end of the barrels may also be further prolonged, and fitted with two holes for the clevis pin, to give one horse an advantage over the other when two of these devices are used with a team.

AN IMPROVED COTTON PICKER.

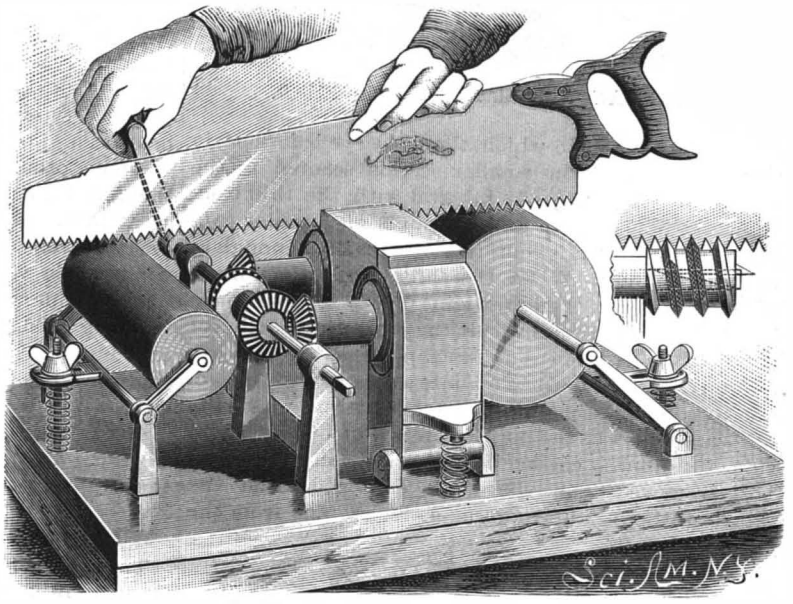
The cotton crop of the United States, for the last three years, has been between six and a half and seven million bales, of 450 pounds each, per year. Enormous as such crops are, there is no room for doubt that, with the introduction of a practical and economical cotton picker, the crops would be greatly increased, and the most severe labor that is now performed in the Southern States, and which is always more or less slighted on account of scarcity of hands, would be greatly ameliorated. These considerations give exceptional interest to any invention intended to facilitate cotton picking, a machine for which is shown in the accompanying illustration, being the subject of a patent recently issued to Mr. William H. Rohling, of Lula Station, Miss. The body of the machine travels on three small wheels, the front one being centrally arranged. It has a horizontal base, inclosed sides, and the top inclines at a decided angle from the rear downwardly to the front, the top surface being formed of a series of longitudinal slots, giving it a grate-like appearance. Within this body is journaled a main axle, upon which are ordinary sized vehicle wheels outside the body, that carry the driver's seat, to the standards of which the draught pole is attached. The large wheels, one of which is hidden by the body of the machine, are intended to travel one upon each side of a line of plants from which the cotton has been previously

ROHLING'S COTTON PICKER.

stripped, while the body is drawn between the stripped row and the line of plants from which the cotton is to be gathered. Motion is conveyed to the strippers by grooved pulleys attached to the main axle, through the transverse shaft and bevel gears shown near the top of the machine, the strippers revolving toward each other as the machine advances, and delivering the cotton bolls on the downwardly inclined slotted top surface of the body. The main axle also operates, through geared wheels, inside the body of the machine, an endless belt, which travels in a line parallel with the forwardly inclined slotted top of the body, and attached to this belt are rows of vertical teeth, which protrude through the slots, the teeth having sharp, angular, hook-like points, inclined to the rear of the machine, which carry the cotton bolls delivered by the strippers to a chute or spout, partially shown in broken lines at the rear. This chute has one open side and a contracted open bottom, and with rear brackets is made to form a chamber behind the rear curved portion of the top part of the body of the machine, the picker teeth on the endless belt that has carried the cotton thus far operating to here separate the cotton fiber from the bolls. A brush is fitted upon a shaft in the lower portion of this rear chamber, in position to engage the picking teeth, removing the cotton therefrom, a chute or flue opposite the brush affording an exit for the chaff gathered with the cotton, which falls into the larger compartment below, where it is removed as desired. The strippers upon one side, as the machine is drawn forward, engage the plants as yet untouched, while the strippers upon the other side gather any bolls remaining upon the previously stripped row.

AN IMPROVED SAW FILING MACHINE.

The illustration herewith shows a novel machine for sharpening straight edged saws, recently patented by Mr. John Sattes, of Butte City, Montana. Upon the base plate is a double-armed standard, apertured to receive two mandrels, which carry bevel gears that give motion as the crank arm is turned by the operator. Upon the mandrels are mounted cylinders having screw threads, the central portion of the threads formed with file teeth, while the ends of the threads are uncut. The thread of the cylinder on one of the mandrels is a right hand thread, while on the other it is a left hand thread, and the pitch in both cases is double that of the teeth of the saw. At the side of the base plate are pivotally connected arms, which, in connection with the central post or standard, extending on either side over the cylinders, form movable jaws, normally held together by a spiral spring near the base plate, these jaws having a yielding hold upon the saw while it is being ground. The rollers upon which the ends of the saw rest may be either wood or rubber, or other suitable material not calculated to injure the teeth of the saw, while acting as supports therefor. In sharpening a saw it is placed between one pair of jaws, with its weight resting upon these rollers, which are readily adjustable to the desired height; then, by turning the crank, the file teeth enter every second recess between the saw teeth, the saw advancing with the revolution of the cylinder carrying the thread, the portion of the thread that is not cut as a file operating as a gauge to limit the depth of cut made by the file section of the thread. After the saw has been thus passed through the jaws on one side, it is placed in a similar way between the other pair of jaws, and in a second operation the other set of recesses between the saw teeth is entered by the threads upon the cylinders and the second set of teeth sharpened. It is of course obvious that special saws will require special file cylinders, but the arrangement is such that the cylinders may be quickly and easily put on the mandrels, and it is calculated that a single cylinder will last as long as a saw of the same relative pitch.



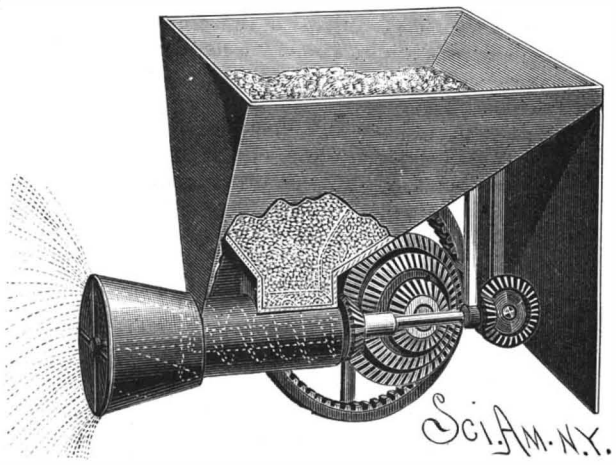
SATTES' SAW FILING MACHINE.

Salicylic Acid in Beer.

The author puts 100 or 50 c. c. in a roomy separating funnel after acidifying with 5 c. c. dilute sulphuric acid, and adds an equal volume of a mixture of equal parts of ether and petroleum ether. He then shakes up the mixture well and distills the filtered ethereal layer into a flask to within a few centimeters. Into the flask, while still hot, there are put 3 to 4 c. c. of water. It is agitated, a few drops of a dilute solution of ferric chloride are added, shaking gently, and the liquid is then filtered through a moist paper. If salicylic acid is absent, the filtrate is clear as water, with a faint yellowish color; if present, the filtrate has the well-known violet color.—*Rose.*

A SEED SOWING DEVICE.

The device herewith illustrated, which has recently



LOVE'S HAND SEED SOWER.

been patented by Mr. William E. Love, of Madison, Tenn., furnishes a positive feed seed sower, in which the supply of seed will not be cut off by sticks or straws choking the feed, and with simple means of adjustment for regulating the quantity of seed to be sown. The hopper, which is designed to be suspended in front of the operator, has a reduced outlet, in registry with an aperture in a tubular casing below, in which is a hollow shaft carrying a spiral feed screw, this feed screw being operated by a cone gear upon the same shaft as the hand crank, and its motion made faster or slower according to the portion of the cone with which it is adjusted to intermesh. Inside the hollow shaft carrying the feed screw is journaled a shaft, upon the outer end of which is an annular distributer, its inner surface having spirally arranged blades to facilitate scattering the seed, while motion is communicated to the rear end of the shaft, through bevel gears and a transverse shaft, from the inner periphery of a hand wheel to which the hand crank is attached. A machine constructed upon this principle may also be carried upon a wagon or other vehicle, power being supplied from one of the axles, and the machine may be used for sowing fertilizers as well as seed.

Crystals in Basic Converter Slag.

At a recent meeting of the London Chemical Society, Messrs. J. E. Stead and C. H. Ridsdale described a series of crystals found by them in the center of large blocks of basic converter slag which had been allowed to gradually cool. The chemical composition of these crystals was examined by the authors, and their crystalline forms determined by Mr. Meiers. The largest crystals were of a faint yellow color, and were flat and square in form; in composition they agreed with the formula $4CaO.P_2O_5$, and were identified as similar to those which had been previously described by Hilgenstock. Blue crystals were also noticed, and were found to contain, in addition to phosphoric acid, a quantity of silica and a small percentage of vanadium oxide. The formula given by the authors was $CaO.P_2O_5.CaO.SiO_2$. In addition to the above, crystals of a feather-like form, containing a large percentage of bases, such as magnesia, lime, and the oxides of iron, were described; also others in smaller quantity —hexagonal and lemon colored—consisting for the most part of basic phosphate of lime; and lastly, two varieties of flat black needles, containing no acid oxides, but consisting of compounds of lime, alumina, and oxides of iron.

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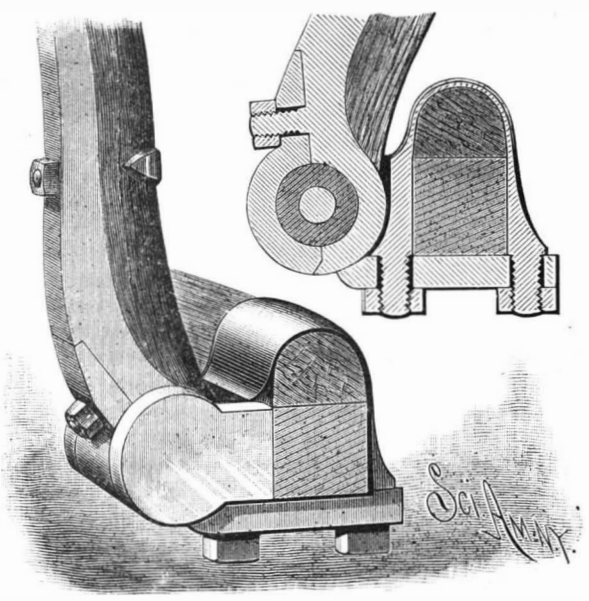
AN IMPROVED THILL COUPLING.

In the invention herewith illustrated, recently patented by Messrs. Peter T. McMillan and Hallet T. Hill, of Bay Shore, Suffolk County, N. Y., the thill coupling eye is made in sections to adapt the thill to be connected to the jack clip without removing the clip bolt or pin. One of our views is a sectional elevation, showing the thill elevated for detachment from the clip, and the other is a side view, with the curved end of the thill in the position in which it is held in the thill loops of a harness. The jack clip is attached to the bottom of the axle by a cross piece, which has a slight forward projection in contact with the thill eye, the clip also having forwardly extending cheek pieces holding an inwardly extending pin, seen in the center of the thill eye in the sectional view. In this view, also, is clearly

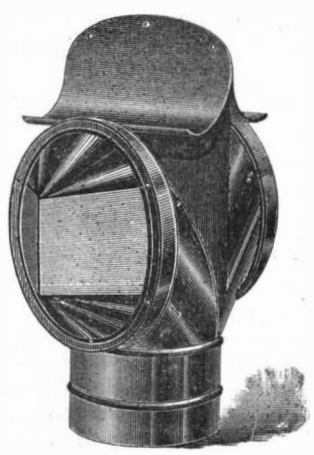


McMILLAN & HILL'S THILL COUPLING.

shown the manner in which the thill eye is formed in two sections, and the smaller section secured to the larger one, which is made integral with the thill iron. Between these sections and the pin is an annular rubber packing, which is compressed in position enough to prevent rattling. When the thills are in the normal working position, the lower joint of the sections forming the coupling comes within the projecting portion of the bottom cross piece of the clip, so that the projection forms a safeguard to obviate all danger of the section becoming accidentally detached; but when the thills are raised to the position shown in our sectional view, the joint is carried down, so the section may be easily removed, and the thills detached from the vehicle without removing the bolts or pins from the jack clip.

AN IMPROVED VENTILATOR.

The chimney cap or ventilator shown in the accompanying illustration is the invention of Mr. Hiram F. Henry, of Gowanda, N. Y., and for which he has recently received letters patent. It is constructed in such a manner with caps over the openings that the wind is prevented from blowing down the pipe or opening, while, at the same time, there is nothing to prevent the free exit of the heated air and the products of combustion, there being a free and unobstructed passage upward. While thus preventing storms and winds from taking a downward current, it keeps up a constant draught in the flue or pipe, utilizing to that end



THE HENRY VENTILATOR.

the motion of the air, from whichever direction it may come. The cones at the ends of the branches, together with the saddle or deflector (which may be used if desired), deflect the wind so as to cause it to pass over the space between the cones and the ends of the branches, thereby increasing the draught and producing a steady current of air.

THERE was recently unearthed at Jacksonville, Ill., while excavations were being made for the asylum for the insane, an apple which is believed to have been buried fourteen years. The apple was in good condition considering its age.

THE RUDGE BICYCLETTE.

Of the various forms of outdoor exercise, it is now generally admitted that 'cycle riding is one of the most healthful and delightful. The movement of the lower limbs in driving the pedals, the gentle force given by the arms in steering, and the constant undulations of the body with the motions of the vehicle, result in a rapid and general strengthening of the system; while the mere act of riding in the fresh, open air, amid constant changes of scene and prospect, brings on a peculiar cheerfulness and exhilaration of spirits that compensate a thousandfold for all the bodily exertion involved.

Those who have been deterred from the pleasures of 'cycle riding by fear of accident on the high wheel will dismiss all their fears if they use the Rudge bicyclette, of which we here give an illustration.

It is safe in every respect, a header being impossible; the seat of the rider being so low, he feels as secure as when on his feet; in fact, his feet are only a few inches from the ground, so that if it were possible to fall, no injury would arise. The wheels are of equal size, the hind wheel being the driver by means of an endless chain, communicating from the hub to the pedals, which are situated between the two wheels. The front wheel is the steerer, so that the power required to propel the machine does not affect the steering, as in the ordinary bicycle. On this account, and the proximity of the rider to the ground, a learner can make himself master of the art of riding in a much shorter time, and with considerably less danger, than upon the ordinary bicycle.

As a runner on level ground, its speed fully equals the ordinary bicycle; and as a hill climber, it easily excels any type of bicycle, as this fact has been proved time and again.

THE RUDGE BICYCLETTE.

Among other advantages claimed for this vehicle are the following: Perfect immunity from headers, very great brake power, easy mounting and dismounting, great power up hill, ease of working against head winds, little vibration and bumping, ability to ride where ordinary 'cycle or tricycle could not venture, no skidding when driving up hill, maximum of speed with minimum of exertion, comfortable foot rests, little splashing from mud and wet, saddle and handles raised at will.

For further information address Messrs. Stoddard, Lovering & Co., sole agents, 152 Congress Street, Boston, Mass.

THE TOTAL SOLAR ECLIPSE OF AUGUST 19, 1887.

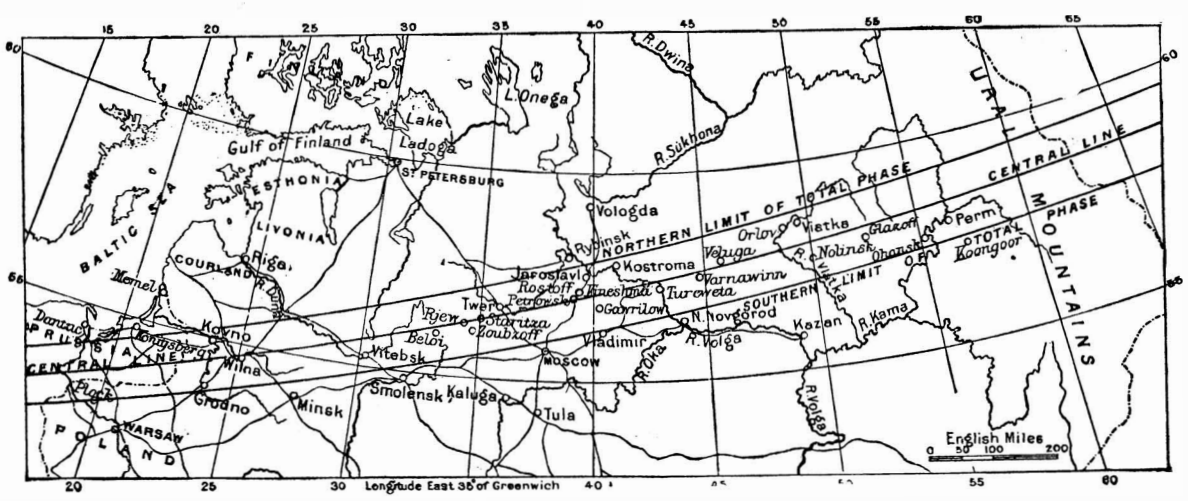
The total solar eclipse of the sun which will occur on August 19 next, though only of average duration, will offer exceptional opportunities for observation from the circumstance that the track of the moon's shadow will be almost entirely a continental one, in striking contrast to the eclipses of the last four years, in all of which the shadow has followed a course which has been principally over the great oceans. The eclipse is technically a partial one for the principal part of Great Britain, but as it will be nearly over before sunrise, it will practically not be visible here. The middle phase will have been reached at sunrise for places a little to the west of Berlin; and this city lying within the path of the shadow, it is just possible that it may be favored with a sight of the phenomena of totality, though with a sun close to the horizon; for the sun will be largely obscured as it rises, and will not be quite 3° high at the end of the total phase.

From Prussia the shadow track passes into Russia, and the central line does not leave the borders of the Russian empire until it reaches east longitude 112°. It then crosses Manchuria and the Sea of Japan, and cuts the principal island of the Japanese group a little to the north of the capital. The final portion of its course lies over the North Pacific Ocean, and except for the little island of Rico de Oro, it does not touch land again. But the path of totality not only lies mainly over land, a large number of important towns are either actually included within or lie very close to its limits. Konigsberg lies just outside. Kovno, Wilna, and Vitebsk are well within the shadow, Wilna being nearly on the central line.

At these towns, however, the sun will still be too low for them to afford desirable stations for observations, and probably the neighborhood of Moscow will be the nearest district which will be occupied by astronomers. At Moscow itself the eclipse will not be quite total, since that city lies just outside the southern edge of the shadow track, but three lines of railway radiating from Moscow will afford easy access to places actually on the central line. The most westerly of these three railways is that which unites St. Petersburg with the older capital, and which passes through Twer. Twer is nearly on the central line, but a little to the north of it.

The sun will have an elevation of about 16° in this neighborhood, and the maximum duration of totality is not quite two minutes and a half. At Twer itself it will be only 124 seconds. Three parties—two German and one French—will take up positions within the government of which Twer is the capital. The second line runs from Moscow to Vologda, passing through Jaroslavl, which lies within but near the edge of the shadow. Petrowsk, on this railway, is very near the central line, and here the sun will be 2° higher than near Twer, and the duration 152 seconds. The third line runs to Kineshma, which is itself very near the central line. Here the sun will be about 20° high, and the total eclipse on the central line will last 156 seconds. It will not, however, be difficult to proceed to yet more favorable positions further east. From Moscow there is a line through Nijni Novgorod to Kazan, and a service of river steamers runs thence up the River Kama to Perm. Perm lies to the south of the central line, but the totality lasts there 173 seconds, while the sun is 28° high at mid eclipse.

If the weather should be favorable, Perm would be therefore a very suitable station for those astronomers who can spare the time to journey so far. For others, the neighborhoods of Petrowsk and Kineshma will afford readily accessible sites. Prof. Bredichin, director of the Moscow Observatory, has his own private observatory only two kilometers from Kineshma, and very close to the central line; and he has generously offered the hospitality of his house to the Royal Astronomical Society for two English astronomers—an offer which has been gratefully accepted by the society, on behalf of Dr. Copeland and the Rev. S. J. Perry. Prof. C. A. Young (of Princeton, N. J.) also will have his station here, and a strong party of Italian and English astronomers, consisting of Profs. Tacchini and Ricco and Messrs. Common and Turner, will be located at no great distance away, in the neighboring government of Vladimir.



PATH OF THE MOON'S SHADOW—ECLIPSE OF THE SUN, AUGUST, 1887.

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The eclipse being visible in Europe, and from places so readily accessible from England, no government expedition will be sent out to observe it. It is not probable, therefore, that any English astronomers will go so far east as Siberia. It may be hoped that Russian astronomers will make good this defect, especially as four of the principal towns of Siberia lie on the shadow track—Tobolsk, Tomsk, Krasnoiarsk, and Irkutsk; the first and third being close to the central line, and the sun being eclipsed when nearly on the meridian at Irkutsk. A series of Siberian stations is the more to be desired, since, as Prof. D. P. Todd has pointed out in the *American Journal* for March, this eclipse offers an exceptionally favorable opportunity for a concerted scheme of observation. The path of totality coincides in a most remarkable manner with the lines of the Russian overland telegraph, so that it will be perfectly possible to select a series of stations in telegraphic communication with each other, and extending over a line of 100° of longitude, with an extreme difference in the absolute time of totality of more than an hour and a half. It appears, Prof. Todd learns from a letter from Dr. S. Von Glasenapp, that the Russian telegraph service may be expected to give the use of its lines at the time for astronomical purposes. It is certainly to be hoped that so unique an opportunity may not be lost, for it might well happen that some discovery, either in solar research or of a comet or intra-Mercurial planet, might receive in this manner the most satisfactory confirmation and development.

The eclipse may also be well observed in Japan. On the west coast, Niigata, one of the treaty ports, lies well within the shadow on the north, and Takata, a large manufacturing town, on the south, the central line passing through the large fishing village of Idzumosaki, on the high road between the two. The island of Sado, opposite to Niigata, which is free to foreigners, is wholly within the shadow, the central line crossing Sawa Umi Bay. The totality here lasts 198 seconds, with a sun 37° high. On the east coast the important town of Mito lies almost precisely on the central line. The duration here will be 192 seconds, and the sun 35° high. Japan, indeed, offers advantages for observing stations superior to those of Perm, as the sun will be considerably higher, and the duration 20 to 25 seconds longer.—*Nature.*

Many Items of Interest.

How many pressmen are there, asks the *American Art Printer*, who pause to consider how, in numerous ways, they can save trouble to themselves and time to their employers by a little system and forethought. The preserving of make-ready sheets of all jobs likely to be done again, whether in type or plate form, is one of these. There are few offices where regrets for neglect of such a precaution have not been expressed. It is a safe rule to keep the make-ready of every type job until the job has been distributed, and even then the pressman should carefully cut out and preserve the make-ready of all cuts or other difficult or tedious work that may be included in such job, before throwing away the rest. As to electro or stereo plate forms, he should invariably keep and file them, for they are useful. Even should the margins be changed, he can easily cut the pages apart and adjust to the new margins by pasting his old make-ready over the pages in their position on his cylinder or platen.

The Boston *Journal of Commerce* warns its readers not to make the too common mistake of thinking a cheap engineer is the man you want. The engine and boiler which furnish the power are important factors in the success of any business, and no matter how simple or strong they may be, it will pay to put them in charge of a man fully competent to care for them, and particularly so if far from facilities for quick and proper repairs. For a small plant it is not necessary to have the highest grade of ability—for there are grades among engineers—but it is better to pay a suitable man for competent and faithful service than to pay for what may happen through the incompetence or neglect of one whose only recommendation is that he is "cheap."

A good disinfectant is made by dissolving half a drachm of nitrate of lead in a pint of boiling water, then dissolve two drachms of common salt in eight or ten quarts of water. When both are thoroughly dissolved, pour the two mixtures together, and when the sediment has settled you have a pail of clear fluid, which is the saturated solution of the chloride of lead. A cloth saturated with the liquid and hung up in a room will at once sweeten a fetid atmosphere. Poured down a sink, water closet, or drain, or on any decaying or offensive object, it will produce the same result. The nitrate of lead is very cheap, and a pound of it would make several barrels of the disinfectant.

A good cleaning powder for show windows and mirrors is prepared by moistening calcined magnesia with pure benzine, so that a mass is formed sufficiently moist to let a drop form when pressed. The mixture has to be preserved in glass bottles with ground stoppers, in order to retain the easily volatile benzine. A little of the mixture is placed on a wad of cotton and applied to the glass plate. Do not use near a fire or light, as the benzine vapor is very inflammable and explosive.

Mr. Emil Kaselowsky, of Berlin, proposes to guide a torpedo, in its exit from the tube, by mounting in the forward end of the tube a box or sheath, having a rod with a T shaped groove in its under side, running the entire length of the rod. The torpedo is provided with a stud corresponding to the groove, and as the torpedo leaves its tube the stud slides into the groove—the rod having been run out by means of a crank or other contrivance—and the torpedo is thus supported and directed until it is well out from the vessel or other place of discharge.

The same inventor has a device for releasing the brake of a torpedo, consisting of a small cylinder on the rear end of the tube, and connected with the tube by means of an orifice, to admit a part of the propelling gas into the cylinder. The gas so admitted at the time of discharge actuates a piston, the rod of which extends to the forward end of the tube, and is there attached to a lever connected with the block or brake. The lever being thrown back by the action of the rod, the brake is released and the torpedo expelled. A spiral spring within the cylinder brings the brake back into position.

The *Public Service Review* says a third invention by Mr. Kaselowsky is designed to avoid the firing, and consequent premature explosion, of a torpedo before its release from the tube. He provides a stop to prevent the firing mechanism from operating, and at the proper time the turn of a hand lever removes the stop, and by the same motion the cap over the mouth of the tube is swung aside so as to release the torpedo, and the firing mechanism is actuated.

At this season of the year the annoyance caused to animals by flies and mosquitoes often amounts to positive agony, and at all times, in what is called good corn weather, it is sufficient to prevent the stock eating enough to keep them in good condition. The animals will stand in the water or pass the greater part of the day in the shade rather than expose themselves to the sunshine, going out to eat only when driven by hunger. They quickly lose flesh, the flow of milk shrinks, and a loss is incurred that cannot be easily made good again. At all times a good feed of grain is beneficial to stock, but it is especially so when flies are very annoying, since it will do much to prevent shrinkage of flesh and milk. Horses and milch cows may be protected, in a great measure, by wiping them all over with a sponge dipped in soap suds in which a little carbolic acid has been mixed.

Screws that are too small for separate treatment may be cleaned from rust as follows: Take a pound of screws and place them in a small box, a cigar box will do; put a small quantity of oil on them and shake for a minute; then put a piece of cotton waste in the box, and repeat for a minute; finally put a handful of sawdust in the box, and shake for another minute or so, and remove the sawdust by sifting it from the screws in a fine sieve. The screws will come out well cleaned.

The cleanest and most perfectly polished floors have no water used on them. They are simply rubbed off every morning with a large flannel cloth, which is soaked in kerosene oil once in two or three weeks. Take the cloth, and with a rubbing brush or stubby broom go rapidly up and down the planks (not across them). After a few rubbings the floor will assume a polished appearance that is not easily defaced.

S. Smirke, R.A., in the *Architect* (London), says the application of volcanic scoria or pumice to the construction of the vaulting of the corridors of the amphitheater at Catania is worthy of observation, and bears witness to the constructive ability of the Roman builders. The springings and various main ribs are executed in very sound brickwork, while the interstices, spandrels, and other parts of the vaulting, are wholly executed with this light yet hard material, in its rough state, but run in solidly with Pozzolana cement. That this mode of construction is substantial is evident from the permanence of the work in these ancient corridors. The dome of the Pantheon at Rome is executed in the same manner, and has stood the sieges, earthquakes, and all other causes of damage and decay, for nearly two thousand years. Perhaps I may here be permitted to say that I think it worthy of inquiry whether a safe, permanent, perhaps even economical, vaulting might not be similarly executed with coke, a material which has many of the properties of a volcanic scoria, is extremely light, and yet so hard as to be able, like the diamond, to scratch glass.

BLACKBERRY vines should be well cultivated after the fruit has been picked. The old canes should not be cut out until late in the fall, but the new canes, which are to produce next year's crops, will be greatly benefited by cultivation.—*Farm, Field and Stockman.*

Correspondence.

"Myriads of Cotton Worms."

To the Editor of the Scientific American:

The above heading in your last issue should have been "Myriads of Caterpillars." The cotton worm comes later in summer or early fall, and eats cotton leaves in preference to anything else.

These caterpillars are comparatively new to us. They hatch out with the budding of the leaves—like the apple tree caterpillar, which they resemble, only they do not surround themselves with a silk webbing in bunches like they do. They seem to prefer black and other kinds of gum leaves, and oak leaves.

The flat swamps of Lynches River are about one mile wide, and are largely wooded with gum trees, and last year these pests ate every gum leaf and pop ash leaf from its junction at Pee Dee for twenty or thirty miles up Lynches River and adjoining swamps and branches, and the water looked like ink in many places.

They do not attack field crops. I send you a cocoon containing one in a chrysalis state. E.

Johnsonville, S. C., June 5, 1887.

Colored Glass.

Until quite recently, but little colored glass, with the exception of common black and amber bottles, was made in this country. Now quite a number of glass works are engaged in its manufacture exclusively, and at others it forms a large part of the product. Some of the most beautiful colored glass produced in the world, rivaling in depth and richness of coloring, as well as in beauty of design, that from the famous works of Europe, is made at the flint glass works of the United States.

The coloring materials most largely employed are iron, manganese, copper, cobalt, and gold. These are generally used as oxides, though in some cases, but very rarely, other compounds are used. In addition to the above, arsenic, uranium, chromium, and silver are occasionally employed.

As was pointed out by Bontemps, many years ago, the coloring properties of the metallic oxides are greatly modified by the degree of heat to which the glass is subjected, and by other circumstances. Not only will different temperatures give different shades of the same color, but even different colors. Manganese, for example, which is the great decolorizer of glass, so universally used for the purpose as to be known as "glass maker's soap," is used as a colorer chiefly to impart a pink or purple to glass. If, however, the glass so colored remains too long in the furnace, it becomes pale or reddish brown, then yellow, and finally green.

From the oxides of iron, all the colors of the spectrum may be produced, and in the order in which they appear in the spectrum. Its primary effect upon glass is to give it a green tinge. Hence in the manufacture of white glass, sand containing much iron is carefully avoided; what little it does contain—and there is always more or less present—is neutralized by the oxide of manganese. Oxide of iron, however, produces other colors than green. Indeed, the green of this oxide has but little brilliancy, and when rich emeralds are desired other materials are used, such as oxide of copper. Iron will produce in enamels, which are only glasses, a fine purplish red, or, under a stronger heat, an orange. If a piece of iron is thrown into the pot of a flint glass house during the blowing, the glass in its neighborhood will be orange or yellow. In window glass houses, the addition of a small proportion of oxide of iron gives a bluish tint to the glass, while it is well known that the glass left in the pots of the bottle houses becomes an opaque blue.

Oxide of copper is chiefly used to produce reds, rubies, and purples in the cheaper kinds of glass. To produce these reds with copper, however, requires skillful manipulation, as they are not all fixed.

The temperature must be kept at the lowest possible point, otherwise the glass changes to a purple, then to a sky blue with a tendency to green. A heat between the maximum, which gives a blue, and the minimum, which gives a red, produces a purple.

The finest rubies, reds, purples, violets, etc., are produced by gold. The purple of Cassius (which is a mixture of the oxides of gold and tin) or some similar preparation of gold is used. The coloring power of gold is so great that one part of gold will give a full, rich body of color to from 600 to 1,000 parts of glass. The glass colored with gold can be made to assume a scarlet, carmine, rose, and ruby.

Cobalt gives a blue which is unalterable in any fire. It is also used for some of the finer blacks.

Carbon, usually as powdered cannel coal, is the coloring matter chiefly used in the manufacture of black and amber bottles. Plumbago was at one time largely used, and still is to some extent.—*Mineral Resources of United States.*

OIL stains may be removed from paper by applying pipe clay powdered and mixed with water to the thickness of cream; leave on for four hours.

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AN UNSINKABLE, SELF-RIGHTING LIFEBOAT.

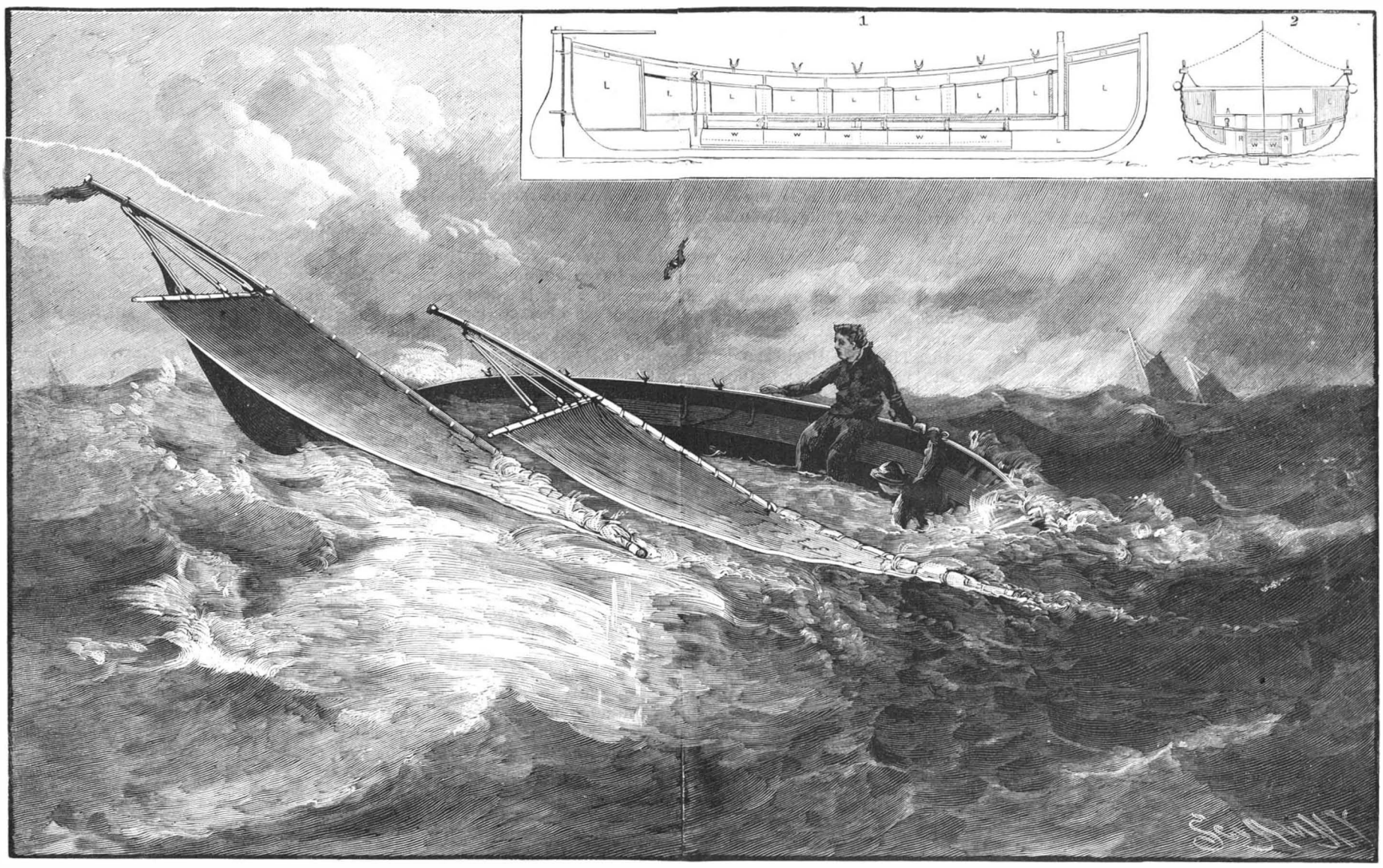
In January last the Committee on Life-Saving Appliances of the U. S. Board of Supervising Inspectors of Steam Vessels made a unanimous report, which was approved by the Treasury department, recommending the Norton lifeboat, a representation of which as it appeared in a rather severe trial off the Delaware coast is shown in the accompanying illustration. The picture is not in the least overdrawn to show the extent to which the lee side of the boat was submerged, for it was more than half full of water and the gunwale completely immersed, not in a spray or under a mere wave, but below the water line.

The boat is made with two distinct frames and plankings or skins, and between them, along the bottom and each side of the keel, are automatically working water ballast chambers, with comparatively narrow arms extending a greater or less distance around the bends, with longitudinal openings near to and in a line with the keel, the openings and chambers being so formed and connected as to be water tight. To the chambers is connected a small air pipe which passes up vertically between the chambers and frames, connected with a longitudinal pipe running on each side below the covering board of the two frames and fitted with a small air valve, which permits the air to escape from the ballast chambers as the water enters, while retaining the air in the ascending arms of the chambers. The remainder of the space not filled by the ballast chambers is occupied by hermetically closed air chambers. Figs. 1 and 2 show longitudinal and transverse sections of the boat, in which L represents the air chambers, W water ballast chambers, R discharge pipes for any water the boat may take in, H openings in ballast chambers by which the latter are automatically filled when the boat is placed in the water, and A the longitudinal air pipe with which the small air pipes connect from the main portion of each water ballast chamber. The air chambers are sufficiently large to keep the boat from sinking when filled with men and water. The air pipe, which allows the air to escape from the ballast chambers, does not allow it to re-enter from the outside, except upon the opening of a valve. The air contained in the side arms or wings of the ballast chambers, which extend up between the sealed air chambers, L, as seen in the longitudinal section, cannot escape, but is detained there, and acts as an air cushion to ease the motion of the boat. Also, when the latter is canted over from an upright position, the air is compressed in the arms on the submerged side, and aids the weight of water lifted by the chambers on the opposite side to right the boat.

Boats may be built on this principle of any of the usual boat-building materials, but are preferably constructed of corrugated yellow metal, of which the boat tried by the naval board was made. Its length was 26 feet, beam 7 feet 3 inches, depth 3 feet 6 inches. At the time of trial the wind was blowing 46 miles an hour, with a rough sea, and Captain Norton, in order to show the great stability, buoyancy, and self-righting power of his boat, spread much more canvas than would ordinarily have been justifiable, the wind throwing her down nearly on her beam ends, with her lee gunwale between two and three feet under water. She answered her helm well, even in this position, and immediately righted when the main sheet was eased off to relieve her from the full pressure of the wind, finally being run on the beach, through the surf, full of water, but so that her occupants were in jumping distance of dry ground. On the day following this trial a 22 foot boat of the same construction was, by order of the committee, several times capsized, with tackle, to test her self-righting qualities, but always righted immediately the same way she went over, as soon as released.

Lifeboats constructed according to Captain Norton's patent have gained high commendation during the past two years in Europe, where they have been tried at several Danish and German life-saving stations. Captain Norton himself, formerly an officer in the United States Navy, says: "I have tried one of these boats, 28 feet long, during a stormy night on the North Sea, 20 miles from land, and found her all that I could desire."

This system of construction is also designed for all classes of vessels, and such work will be undertaken by the Norton Naval Construction and Shipbuilding Company, of New York and New Jersey, Captain F. L. Norton General Superintendent, No. 633 F Street, Washington, D. C.



TRIAL OF THE NORTON PATENT LIFEBOAT IN A GALE OFF THE LIFE-SAVING STATION AT LEWES, DEL.

RIGHTS OF THE INVENTOR.—The Wisconsin supreme court, in the case of the Fuller & Johnson Mfg. Co. vs. Bartlett, has rendered a decision of much interest to inventors, being an action to enforce the specific performance of an alleged implied contract to assign to the plaintiff an invention made by the defendant while in the employ of the plaintiff and before procuring a patent. The court decides that the mere fact that in making an invention an employe uses the materials of his employer and is aided by the services and suggestions of his co-employes and employer in perfecting and bringing the same into successful use, is insufficient to preclude him from all rights in it as an invention. An implied contract to assign such rights cannot be enforced from mere passivity of the inventor. It is the conception in the perfected machine, not the materials, workmanship, and skill employed in its construction, which constitutes the invention, and the defendant, as the inventor, was the lawful owner of the invention in his own right. The above is a question constantly arising between inventors and employes, and patent attorneys are frequently called upon to decide between the parties. This decision will likely settle a good many disputes.

A New Destructive Cricket in Louisiana.

A rather remarkable insect pest has come to light the present season in Catahoula Parish, La. It is a true cricket of the genus *Gryllus*, but the specimens so far received have been too badly damaged for specific determination. Mr. Michael Dempsey, of Jena, writing under date of May 7, says: "They infest portions of the hills and swamp lands alike, doing irreparable damage to cotton, sweet and common potatoes, peas, and tobacco. Our farmers are seriously alarmed at their fearful increase and their destructive habits. Their holes in the ground are promiscuously scattered from a few inches to several feet apart, and are seldom over a foot deep in the uplands, although they go much deeper in the swamp lands, as the soil is deeper and the subsoil softer. They are seldom visible in the heat of the day, and do their cutting at night, taking all they want down into the ground, where they eat as they please. . . .

"In 1852 I first noticed them eating young cotton only, and a few years back they began to eat sweet potatoes; now they eat peas and tobacco, and have attacked our gardens. Our parish is composed of small farmers, who lack means. . . . We find that rapid cultivation, large gangs of poultry, and numerous birds keep them in check, but they are becoming too numerous in spite of all we can do."

Beyond doubt, in a case like this the best remedy will be found in the use of a poisoned bait, and I have no doubt but that the bran, sugar and arsenic mash which proved so effective against the devastating locust in California in 1885, and which is described in my annual report for that year (Rep. Dept. Agr. for 1885, p. 300), would prove attractive to the crickets, and would accomplish the destruction of large numbers.

This preparation is usually prepared in wash tubs or half barrels. One of these is filled about three-fourths full of dry bran, and to this is added about five pounds of arsenic, which is thoroughly stirred through the bran with a spade or shovel. Five pounds of sugar is next thrown into a pail, which is then filled with water and the sugar stirred until it is dissolved, when this sugar water is added to the bran and arsenic and the three well stirred; more water is added, and the stirring continued until every portion of the mash becomes thoroughly saturated. This should be placed about the infested fields in tablespoonfuls.

Freshly cut grass or other green vegetation, sprinkled with Paris green or London purple, and scattered at intervals throughout the fields, will also produce good results, and be less expensive. PROF. C. V. RILEY.

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THE TWELVE-WIRED BIRD OF PARADISE.

Two years were spent by Dr. F. H. H. Guillemard (1883–85), of England, with his steam yacht in natural history explorations in Kamschatka and New Guinea, and the results of his observations are given in two royal volumes, superbly illustrated, published last year in London, entitled "The Cruise of the Marchesa." After infinite labor and expenditure of much time, he at last succeeded in securing two or three living specimens of that most rare bird, *Seleucides nigricans*, the twelve-wired bird of paradise. The author says:

"The native-prepared skins seen in European museums give no idea of the glorious beauty of the living bird. The subular plumes, whose prolonged and wire-like shafts have given the bird its English name, are of a rich golden-yellow, and the pectoral shield, when spread, shows to advantage its tipping of metallic emerald.

"These exquisite creatures were fed on the fruit of the pandanus, with an occasional cockroach as a *bonne bouche*. In devouring the insects, which they did by throwing them in the air and catching them again, they displayed the wonderful grass-green coloring of the inside of the mouth and throat. The feelings of admiration with which I watched these birds, which are among the most exquisitely beautiful of all living beings, I need not attempt to describe. My reader, if a naturalist, will divine them; if not, no description of mine would ever make him realize the intense pleasure of the first sight of such masterpieces of coloring."

On another occasion, speaking of one of these birds, the author says:

"The bird, a male in full plumage and already tolerably tame, was brought in in its bamboo cage, and although we had previously seen this species alive in the aviary of the Resident of Ternate, we could hardly keep our eyes off our new acquisition, so striking was its beauty.

"He became tame very quickly, and would readily eat from our hands. By day he usually remained more or less quiet, and was fond of resting motionless, with the head sunk low on the chest; but in the morning and evening he moved restlessly from perch to perch with a peculiar bounding hop. His manner of feeding was wonderfully neat. Any cockroach that ventured into his cage he would catch with lightning rapidity, seizing it across the body with his long, sharp beak. Then giving it a sudden snap, he would throw it in the air and catch it lengthways, displaying the vivid grass-green coloring of his mouth and throat in the operation.

"The only note he ever uttered was a single unmelodious croak. The least fall in temperature seemed to be felt by this beautiful creature, and though every care was taken of him, he died before we got beyond the tropics.

"The method employed by the natives of New Guinea in catching the Seleucides appears almost incredible. Patiently searching the forest until he has discovered the usual roosting place of the bird, the hunter conceals himself beneath the tree, and having noted the exact branch chosen, climbs up at night and quietly places a cloth over his unsuspecting quarry. The species being exceedingly fond of the scarlet fruit of the pandanus, the roosting places are easily recognized by the dejecta. The plan would, perhaps, by most of us, be regarded as very similar to that counseled by our nurses, in which a pinch of salt is the only requisite; but the noiseless movements of the native hunters overcome all difficulties, and the tree once discovered, the chances are said to be considerably against the bird.

"Finding the tree is, however, not so easy, and the month spent by our natives in the forest resulted in the capture of only one bird. Four days after our arrival they returned again, but this time empty handed. They had discovered a second tree, but one of the Alfuros of the interior had interfered and shot the bird with his blunt arrow.

"In the discussion that ensued our man got the worst of it and retired from the field, having very narrowly escaped being added to his enemy's bag."

THE TWELVE-WIRED BIRD OF PARADISE (SELEUCIDES NIGRICANS).

CONDITION OF THE CROWN PRINCE OF GERMANY.

BY JOHN MICHELS.

The dispatches which have been received from Berlin relating to the serious illness of the Crown Prince have been throughout both vague and contradictory. Although there are other diseases of the throat region, there can be no doubt but that the prince's disease is either *papilloma* or *epithelioma*. The former is considered a benign growth, and the latter the fatal form of disease which attacked General Grant. When portions of these growths can be detached and examined under the microscope, their distinctive characters can be readily observed, for there is a marked difference in their optical appearance. A portion of an epithelial cancer recently came into my possession, from which I made a photomicrograph, using a one-sixth dry Gundlach of 180° aperture, and I offer at Fig. 1 a good drawing made from the same.

The reader will readily notice, at the upper part of the drawing, the large cells having concentric rings. These are called the nest cells, which are seen in this kind of cancer only, and show it to be a growth of the malignant type. These nest cells enable the microscopist to make a decisive diagnosis, from which there is no appeal, as was done in the Grant case by Dr. Geo. R. Elliott. The canals running round the cells, and in which they are embedded, are called the stroma. The dark dots represent the nuclei of the epithelium, of which the whole cancer is built up.

The optical appearance of papilloma is quite different. There are no nest cells. It may then be asked, Why does not Virchow give a decisive opinion? What can make him hesitate when such a vital issue is at stake? The only opinion I can offer, with the dispatches to date before me (June 13), is that Virchow has certainly not found the sections under examination to be epithelioma having the nest cells, as that would settle the question; but that he has found the growth to be that of papilloma. He still hesitates to say that the growth is non-malignant, however, and therefore I should draw the inference that he has found cells and other indications which raise a doubt in his mind as to whether the growth is not undergoing a transitional course from the benign to the malignant type, which is very frequently the case, and always to be feared. The fact that four operations have already been performed, with the rapid recurrence of the growth, are alarming features

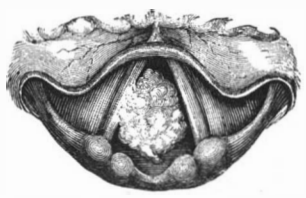

Fig. 2.—VOCAL CORDS ATTACKED BY PAPILLOMA.

Fig. 1.—EPITHELIAL CANCER.

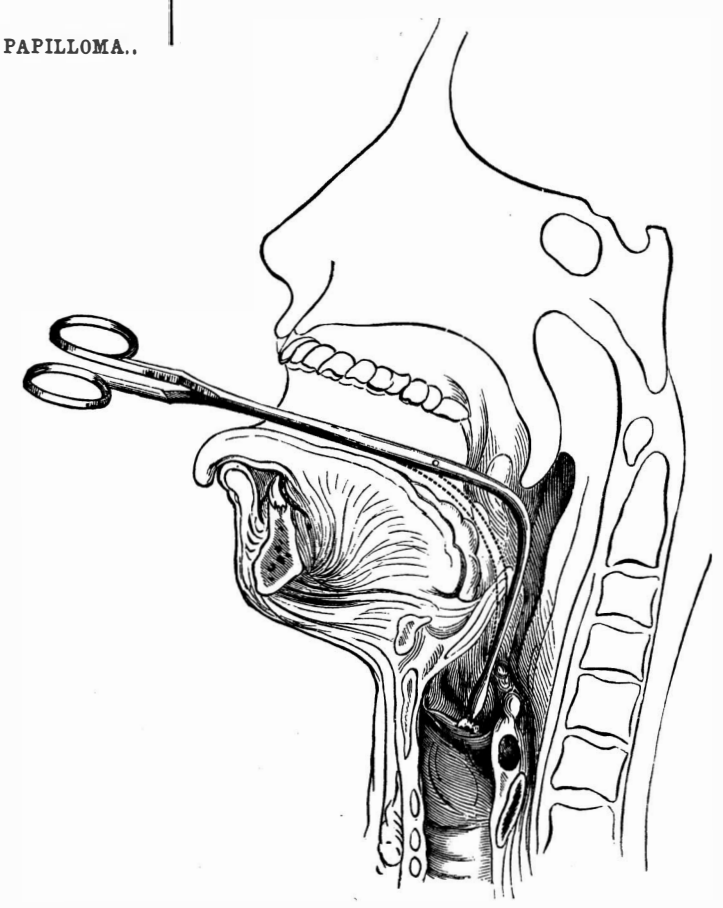

Fig. 3.—REMOVAL OF PAPILLOMA FROM THE VOCAL ORGANS.

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of the case. I give a diagram (Fig. 2) showing the vocal cords, with a papilloma on one of the edges. It is from a drawing made by Dr. Morell Mackenzie, who has recently operated on the prince.

Fig. 3 shows the difficult nature of the operation, which consists in cutting off the small excrescence by means of bent forceps. It requires great skill, as the mere touch of the instrument on the vocal membrane causes spasmodic contraction. The surgeon must grab the wart at one movement or fail.

The papilloma is of the nature of a wart, the same as those which come on the hands and face (*cutaneous*); but when located on the inner mucous membrane, particularly in the larynx, the disease sometimes assumes formidable proportions, closing up the air passages and killing the patient by suffocation.

Dr. Mackenzie has so far been very successful in his treatment of papilloma, where the more serious conditions have been absent. Where tracheotomy becomes necessary, the chances of cure are very remote. According to the most recent advices, he is confident the prince will recover.

I may mention that the portion of epithelioma (malignant cancer) from which I made the photograph shown with this article was taken from the corner of the upper lip. It was removed by an operation, but appeared later in the nose, and the sufferer eventually died. It shows the characteristics of this form of malignant cancer very clearly; so much so, in fact, that it cannot be mistaken for any other kind of tumor.

New Cruisers and Gunboats.

The Chief Constructor of the Navy, with his large force of draughtsmen at the Navy Department and Washington navy yard, and Chief Engineer Melville, with his corps of assistants at Cramp's place in Philadelphia, have made quick work of the plans and specifications for the two 19 knot cruisers and two 1,700 ton gunboats, bids for which are to be opened August 1 next. When the advertisement was issued, April 6 last, inviting proposals for these vessels, and stating that the plans, specifications, etc., would be ready for the information of bidders June 1, not a single stroke of work had been performed in connection with the preparation of plans, and it was hardly anticipated by the most sanguine that the department would be able to furnish the bidders with the information at the time specified. It was only two weeks ago that Chief Engineer Melville, with a large force of draughtsmen, began the preparation of plans for the machinery, and it was not many weeks ago that the chief constructor commenced work upon the plans for the hulls. Much to the surprise of everybody interested, and to the gratification of the Secretary, Chief Constructor Wilson announced promptly on the morning of June 1 that he was ready to exhibit the plans of all the vessels, including those for the machinery which Chief Engineer Melville brought over from Philadelphia, in person, on the same morning, and that the detailed specifications were all written out and in the hands of the printer. This is regarded as remarkably rapid work by those at all familiar with the trials and delays connected with such matters. It is true that some of the plans are copies of others already in existence, but even the work of duplicating drawings requires time. The hulls of the 19 knot cruisers are somewhat similar in design to the Newark, which, with the hull and machinery of the gunboats, are, by law, exact duplicates of Gunboat No. 1, now building by Cramp & Sons. The plans of machinery for the 19 knot cruisers are also similar to the designs for the Baltimore's machinery.

The following is a description of the 19 knot cruisers, which are designated by the department circular as Nos. 4 and 5. The plans and descriptions of the Newark, known as No. 1, and Gunboat No. 1, of which the two new gunboats are to be duplicates, we have heretofore published.

NINETEEN KNOT CRUISERS.

They are to be twin screw cruisers, 310 feet long on the water line, 49 feet 1¾ inches extreme breadth, 18 feet 9 inches mean draught, displacing 4,083 tons. Machinery of 10,500 i. h. p. under forced draught; maximum speed, 19 knots; rig, that of a three-masted schooner, spreading 5,400 square feet of sail. They will have a double bottom extending through 129 feet of the length. The framing in this portion is on the bracket system. Before and abaft the double bottom, above the protective deck, Z bars form the transverse frames. The protective deck, which is 19 inches above water line amidships, is flat across the top, with sides which slope down to a depth of 4 feet 3 inches below the water line. The horizontal portion is 2 inches thick, the slope being 3 inches, reduced at both ends to 1½ inches. It extends uninterruptedly forward and aft, and protects the machinery, magazines, and steering gear, the machinery being further defended by the disposition of the coal bunkers. The main hatches in this deck are protected by armor bars and have coffer dams extending to the upper deck. The guns are carried on the gun, forecastle, and poop decks.

ARMAMENT.

The main battery consists of twelve 6 inch B. L. rifles, all on center pivot mounts, with two inches segmental steel shields, and arranged on sponsons, so as to obtain the greatest possible arc of fire. The forecastle, the poop, and the bridges have been as much as possible availed of to shelter the guns. The two guns forward and the two guns aft converge their fire a short distance from the ends of the ship, and the broadside can be concentrated within 100 feet of the side. Four above-water torpedo tubes are provided on the berth deck, and two direct ahead under-water torpedoes in the bow. The secondary battery is composed of four 47 millimeter revolvers, four 57 millimeter single shots, two 37 millimeter revolvers and one short Gatling. Coal capacity, 850 tons; complement of men, 300.

DETAILS OF CONSTRUCTION.

The vertical keel is 17½ pounds per square foot and 39 inches in depth amidships, the flat keel plates 20 pounds and 17½ pounds. The stem is cast steel, shaped and supported for ramming. The stern post and rudder are also steel castings, the latter 15 inches in diameter at the head. Numerous watertight frames are worked in the double bottom, and throughout the vessel the cellular principle is carried as far as practicable. At a height of about four feet above the protective deck the berth deck is placed, the space between the two being greatly subdivided and mainly utilized for coal stowage, so that the protection to the water line is no doubt as complete as can be obtained in any armored ship. The outside plating is generally 17½ pounds. Lap work is used below the protective deck, but above the plating is flush. The lap work is double riveted at the edges. The inner bottom is in the main 12½ pounds. Bilge keels 24 inches in depth extend for 150 feet of the length. When in action, the vessel will be directed from a steel conning tower 3 inches in thickness, cylindrical in form, located on the forward bridge. There will be a wooden pilot house located on the forward bridge just abaft the conning tower, and arranged to overlook the latter. The tower will be fitted complete with steering wheel, speaking tubes and engine room telegraph. These will be carried below the protective deck through a steel tube 2½ inches thick and 12 inches in diameter. A steam steerer will be located beneath the protective deck.

The arrangements for pumping and drainage are very carefully considered. The system followed may be described as a development of that employed in the Chicago. Pumps are connected with all the important compartments. All the principal water tight doors and the sluice valves are arranged to work from the berth deck.

The ventilation is much more elaborate than in the small vessels. Natural ventilation is favored as far as possible, but, in addition, all living and other spaces below the main deck are carefully ventilated on the exhaust system, the blowers being entirely distinct from those used for producing the force draught in the fire room. Large ducts extend forward and aft on the protective deck, receiving smaller ducts from the various rooms and compartments. Where these ducts pass through bulkheads, automatic valves are fitted to prevent the flow of water from one compartment to the other by way of the air pipes. The coal bunkers are well ventilated, the fresh air supply to the bunkers being obtained through pipes carried up into the hammock berthings.

The ceiling in the hold will be of yellow pine battens, and on the berth deck 2½ pound steel plate will be used, secured to the reverse flanges of the frames by quarter-inch round-headed brass screws. The ward-room will be finished in sycamore, without pilasters, but with suitable mouldings and panels.

There will be two complete electric lighting plants arranged to work on the same circuit, and lights are to be disposed so as to fully illuminate all parts of the ship, including coal bunkers, magazines, shell and ammunition rooms, running lights and lights for use on the upper deck and aloft. The total number of lamps will be about four hundred.

For a second extra knot would be required about 6,000 horse power more, making about 25,000 horse power necessary to develop a speed of 21 knots.—*Army and Navy Jour.*

The Natural Sodas of the West.

During the year 1885, says Mr. J. D. Weeks, in the "Mineral Resources of the United States,"* for the first time, a systematic effort was made to work the soda deposits of Wyoming, and to establish a market for the product in the growing and prosperous towns of the West. No attempt has been made to manufacture anything but the commercial caustic soda, for which quite a ready sale can be had. Lack of railway facilities has held back the development of any beds but those near Laramie.

The soda property, generally known as the "Union Pacific Lakes," lies about 13 miles nearly due south of Laramie, and is reached by a branch of the Union Pacific Railway. The property embraces some 2,000 acres, including five "lakes," in all but one of which the soda is solid. These lakes are connected, and seem to drain one into another. All of the soil near Laramie is more or less impregnated with the sulphate of soda; and the common sources, it is believed, are springs, water from which bears large percentages of soda salts.

The physical condition of the soda in the lakes varies much with the season. In wet years the soda is almost fluid, while in dry years in all but one of the lakes it is solid, and in this one it occurs as a saturated solution. In the solid lakes the soda contains many thin layers of mixed clay and soda.

The soda, when taken pure, contains large quantities of water, which fact interferes seriously with its employment in the manufacture of sodium hydrate. The soda works near Laramie were built by the Union Pacific Railway, and leased to Mr. Howard Hinckley. The process used is the old "black ash," with stationary furnace. The capacity of the works is about two tons of sodium hydrate per day. The capacity of the furnace is three and a half tons of sodium sulphate per day. Rescreened coal from the Rock mine is used, and the limestone necessary is obtained near Laramie. The "black balls" formed of the fused soda, coal, and lime are broken up, and washed in four lixiviating pans, and the liquor is then taken to two setting vats. Thence it is drawn to the "causticizer," which is a large circular tank, in which are two perforated vessels containing caustic lime, around which the solution of sodium carbonate is agitated. After causticizing, the liquor is passed through three long, circular iron settlers. The clear liquor is then drawn to the "V-pan," where waste heat is used to aid the evaporation of the solution. The slightly concentrated liquor is then drawn to the "boat pan," which is set upon the reverberatory furnace. The evaporation is continued as long as possible, and the new concentrated solution is then drawn to another room, into the "finishing pot." This is a large cast iron pot set directly over a furnace. Here, all remaining traces of water are driven off at a low red heat. The hydrate at this stage is generally nearly black. Small quantities of fused niter are added to whiten it. The hydrate is then ladled into sheet iron vessels and shipped. Some of the Laramie caustic soda has been used by the Denver Soap Company, which reports favorable results from the use of it. The works at Laramie are not well adapted to the most economical handling of the soda. Improvements are being made by which the number of men employed will be greatly reduced and the composition of the "black balls" made more uniform.

The Laramie works produced from July to January, 1885, about thirty tons of caustic soda. Defects in the plant caused great delay and loss of some of the caustic soda, and the works were therefore closed for a time until alterations could be made. The lessee of the works states that good reports of the caustic soda have been made by users of it.

The "Downey Soda Lakes" are situated about 18 miles southwest of Laramie, and are three in number, covering, approximately, with the land included, 520 acres. In one lake the deposit is 11 feet thick; in the others, it is from 5 to 6 feet. The soda from these lakes is similar to that from the Union Pacific ones, and there seems to be an underground connection between the two groups.

The soda deposits in Carbon County are situated in the Sweetwater Valley, near Independence Rock, and nearly fifty miles due north of Rawlins. These deposits contain both carbonate and sulphate of soda, and are generally known as the "Dupont Lakes." They are four in number, and vary from 6 to 2,000 acres in area, and are held by United States patents in the name of L. Dupont. There are five claims, known as: New York soda mine (160 acres); Philadelphia soda mine (80 acres); Omaha soda mine (20 acres); Wilmington soda mine (180 acres); Wilkesbarre soda mine (20 acres). Five acres of the Omaha mine are covered with carbonate and sulphate of soda mixed with a little sodium chloride, and sand blown from the surrounding soil. Several bore holes put down showed an average thickness of about six feet.

The Wilkesbarre claim is about a mile west of the Omaha, and the soda is in solution.

The Wilmington claim is located a quarter of a mile west of the Wilkesbarre, and here, too, the soda is in solution. Its depth has never been determined. It has been sounded with a forty foot rope without finding bottom in the center.

The New York and Philadelphia claims are both upon one lake, which is solid, and is four miles west of the Wilmington. A bore hole at a distance of 50 feet from the shore showed 4 feet of soda, and another at a distance of 230 feet from the shore passed through 14 feet of solid soda without touching bottom.

Fifteen miles from these deposits, in the Seminole Mountains, good limestone occurs, containing 2 per cent of magnesia. Near the limestone is a good 8 foot vein of coal.

A comparison of analyses shows that the percentage of carbonate of soda is greater in the Dupont than in the Union Pacific and Downey deposits; but the Sweetwater country is still out of reach of transportation, and until a railroad is built in this direction, the deposits must remained undeveloped.

* Government Printing Office, 1886.

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ENGINEERING INVENTIONS.

A railway rail spring has been patented by Mr. Edward A. Olmstead, of New York City. It is a bowed spring plate with slots through which pass the spikes for securing the rail to the ties, whereby both rail and spring are held in place, it being designed to diminish the pounding effect of heavy trains upon the rails and lessen the noise.

A car coupling has been patented by Mr. Eugene A. De May, of Richmond, Texas. It has a spring-pressed hook attached to or formed upon a rock shaft extending to the top of the car, with a hand wheel to turn it, and there is also a rod extending to the side of the car, for uncoupling cars from the bottom or side, the device being applicable with the ordinary drawbar.

A dumping car has been patented by Mr. Lawrence J. Woodhead, of Chattanooga, Tenn. In connection with hinged sides or gates, it has mechanism for opening and closing and holding them locked in position, while the car has a rounded or convex bottom, which aids in the automatic removal or dumping of the load, the devices being easy to operate, and the car simple of construction and durable.

AGRICULTURAL INVENTIONS.

A potato digger has been patented by Mr. James W. Scott, of Uhrichsville, Ohio. The plow or scraper can be let into or removed from the ground easily by the driver, a rocking motion is given to a shaker to separate the earth from the potatoes as both are raised by the plow in its forward progress, and there are various novel features of construction and arrangement of parts.

A sulky harrow has been patented by Mr. Nathaniel T. Collins, of Hartford, Kansas. The invention covers various novel details in the construction and arrangement of parts, permitting the raising or lowering of the two harrows independently of each other, and the lengthening or shortening of each as desired, while the machine is light, durable, and effective.

MISCELLANEOUS INVENTIONS.

A ball turning lathe has been patented by Mr. Tronson Draper, of Petrolia, Ontario, Canada. It has an adjustable face plate covered with leather and backed by rubber or other elastic material, a pair of tongs having steel cups, an adjustable steel cup placed on a holder, a ball rest, and means for adjusting the steel cup holder, with other novel features.

A lumber register has been patented by Mr. John Thompson, of Minneapolis, Minn. It is made by splining to the axle of a drive wheel a cone pinion, communicating motion to a series of registering disks, the several pinions constituting the cone representing each a standard length of lumber, the cogs corresponding to the number of feet in the length of each piece.

A weather board gauge has been patented by Mr. James H. Smith, of Little Rock, Ark. It is a combined tool, making an adjustable gauge, nail for supporting the board to be next secured to the building, hatchet to be employed in removing nails, try square and straight edge, dispensing with the use of separate nails for holding the board in position while being marked and nailed.

A stump extractor has been patented by Mr. John Cornelius, of Oakland, Md. It comprises a main frame with horizontal shaft having chain and worm wheels, with intermeshing worm, a pulley frame and pulleys supported in the main frame, with a guide so devised that when the machine is anchored to the ground and under strain, the machine will conform to the variations in strain.

A keyboard attachment for musical instruments has been patented by Mr. Henry Richards, of Decker, Ind. The invention consists of a series of keys operating on the keys of the instrument and actuated by a belt having projections, a frame supporting the keys, and provided with means for adjusting them, with a device for moving the belt, whereby a piece of music may be performed on organ or piano.

A ventilator has been patented by Mr. John Williams, of Quebec, Canada. Combined with a fixed cylindric section having a winged fan, and a removable section with duplex screens, are valves hinged centrally within the fixed section and adapted to close against back draughts, with other novel features, the device being designed as a simple and effective ventilator for windows or shafts.

A cuspidor has been patented by Mr. James J. Brennan, of Morris Plains, N. J. It is designed for use in railroad cars, and has an apertured inclined bottom, an apertured inclined cap suspended below the bottom, with a detachable apertured top of novel form, making an article designed to be self-cleaning, which cannot be upset and which will help ventilate the car.

A stop valve for water service pipes has been patented by Mr. Daniel Kearney, of Montreal, Canada. It is designed to facilitate the operating of such valves from within the basement or cellar, instead of from the surface of the ground outside, a piston cylinder attached to the valve having two pipes extending into the basement, so that their ends are easily accessible, by which the stop valve may be moved up or down as desired.

A machine for making wire and slat fences has been patented by Mr. Joseph S. Locke, of Spartanburg, Ind. Combined with a standard and draw wires or bands are spools, bands and clamps relatively arranged to allow the strands of the finished fence wire to be put in tension independently, the fencing to be made along the line of the fence posts, or made in lengths suitable for rolling up for shipment.

A vending apparatus has been patented by Mr. George A. Macbeth, of Glenisla Ealing, Middlesex County, Eng. The invention covers a rotating magazine or multiple hopper to hold a supply of goods, a delivery drawer or slide by which the articles are withdrawn singly, with a mechanism for locking the drawer each time it is pushed in or closed, with other novel features.

A machine for sizing oranges and other fruit has been patented by Mr. Alfred Ayer, of Lake Weir, Fla. It has grading frames with longitudinal ribs, so that the oranges in passing upon them will not be cut or bruised, and beneath each frame a vertically sliding table forming a bed or support for the oranges, with cushions, and other novel features, to facilitate the rapid and exact sorting of the fruit without injury.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Stationary and boat engines, boilers. Best and cheapest. 1 to 10 H. P. Washburn Engine Co., Medina, Ohio.

Water power and mill site on the Little Elk, at Northeast, Md., half way between Philadelphia and Baltimore. 25 feet fall. The *old Crawford Mill property.* Plenty of stone and timber for building uses. Must be sold to close an estate. Call on or address John M. Simpers, Northeast, Md.; or A. D. Atkinson, New Brunswick, N. J.

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Press for Sale—Quick acting. Hole in bed 8x5; punches to center of 13 in. sheet; 2¼ in. shaft; also four spindle Drill. A few second-hand engines in first-class condition. B. W. Payne & Sons, Elmira, N. Y.

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The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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SCIENTIFIC AMERICAN BUILDING EDITION,

JUNE NUMBER.

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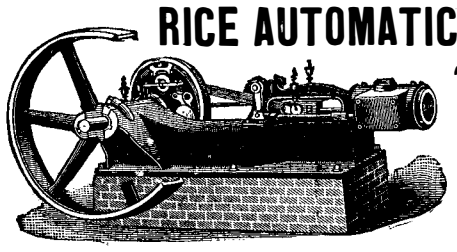

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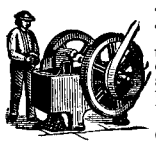

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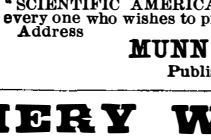

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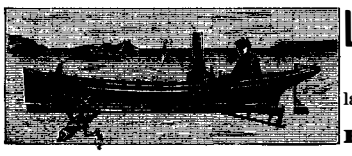

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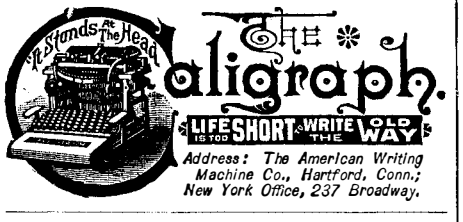

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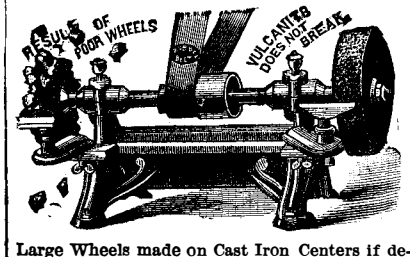

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Proposals for Steel Gun Forgings for the Navy.

NAVY DEPARTMENT,
WASHINGTON, *June* 4, 1887.

Sealed proposals from domestic manufacturers of steel, to furnish ten sets of steel forgings for 6-inch B. L. rifle guns and one set of chase—hoops for a 10-inch B. L. rifle gun, all oil-treated, annealed, and in accordance with drawings and specifications prepared in the Bureau of Ordnance, will be received at the Navy Department until Wednesday, the 6th day of July, 1887, at 12 o'clock noon, at which time, the proposals will be opened.

The kinds of forgings required and the estimated quantity of each, the aggregate being about sixty-five tons, are stated in blank forms of proposal, which together with copies of said drawings and specifications, may be obtained on application to the Bureau of Ordnance, Navy Department.

Prices per ton of 2,240 pounds must be stated in the proposals, which must be made on forms furnished by the Department. Proposals will include, in addition to items embracing all the work required in the manufacture of the forgings as specified, separate items for *tubes, jackets,* and *trunnion bands* to be rough-bored and turned by the Department. In case the Department shall find it advantageous to have that part of the work done at the Navy Yard, Washington, D. C., such forgings will be delivered by the contractor before rougbing, the Department paying freight to and from the Navy Yard, and the rough-bored and turned forgings will be returned to the contractor, F. O. B. at his works.

The contract will be awarded for the forgings as a whole. No proposal for less than the whole will be entertained; nor will any proposal be considered unless accompanied by satisfactory evidence that the bidder is in possession of a plant adequate to the production and delivery of the required forgings. All forgings delivered under the contract must conform in material, manufacture, and quality to the aforesaid drawings and specifications, and must successfully pass the required inspection and tests.

The successful bidder will be required, within ten days after notice of award, to enter into a formal contract binding himself to deliver one set of gun forgings within sixty days from the date of the contract, and not less than one set every twenty-one days thereafter, and to complete the deliveries within nine months from the date of the contract. A bond with sufficient sureties in a penal sum equal to fifteen per cent of the total contract price must accompany the contract.

Blank forms of contract and all additional information desired can be obtained on application to the Bureau of Ordnance, Navy Department.

Each proposal must be accompanied by a certified check, payable to the order of the Secretary of the Navy, in an amount not less than five per cent of the total amount of the bid. Checks of unsuccessful bidders will be returned within five days after the bids are opened. The check of the successful bidder will be returned when he shall have executed the formal contract and furnished the requisite bond; in case of his failure to comply with this stipulation, the check will become the property of the United States.

All proposals must be in duplicate, enclosed in envelopes marked "Proposal for Steel Gun Forgings," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C.

The right is reserved to waive defects in form and to reject any or all bids.

WILLIAM C. WHITNEY,
Secretary of the Navy.

Proposals for Iron Floating Gate or Caisson.

NAVY DEPARTMENT,
BUREAU OF YARDS AND DOCKS,
WASHINGTON, D. C., June 7, 1887.

Sealed proposals, addressed to the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., indorsed "Proposals for Floating Gate," will be received at this bureau by the undersigned until one o'clock p. m. of Thursday, the thirtieth day of June, 1887, at which time and place the proposals will be opened in the presence of bidders for furnishing the necessary labor and material for the construction of an iron floating gate, or caisson, for the dry dock at the Navy Yard, Boston, Mass.

Plans of the floating gate, or caisson, and all attachments pertaining thereto, can be seen and copies of specifications and instruction to bidders obtained by applying to the Bureau of Yards and Docks, Navy Department, the Civil Engineer's office at the Navy Yard, Boston, Mass., or at Navy Pay Office, cor. Broadway and Chambers Street, Stewart Building, New York city.

The bureau reserves the right to reject any or all bids that may not be deemed advantageous to the government. No proposal will be considered unless accompanied by the prescribed bond which forms a part of the same.

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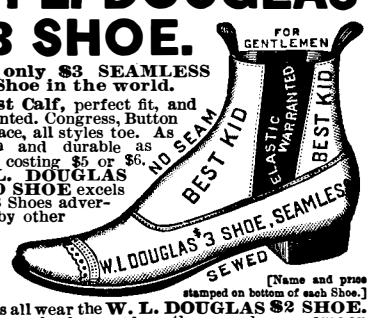

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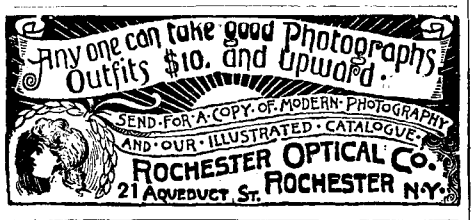
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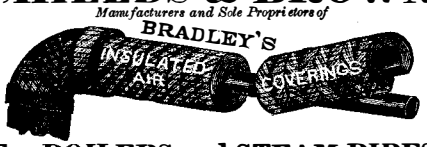

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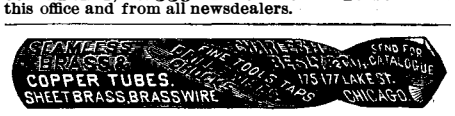

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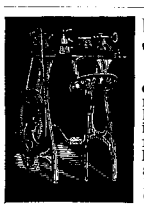

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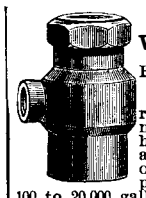

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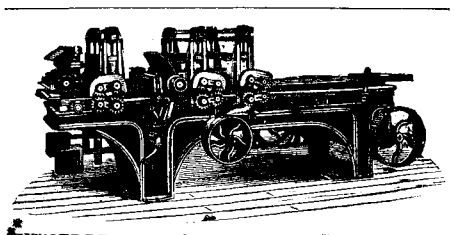

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